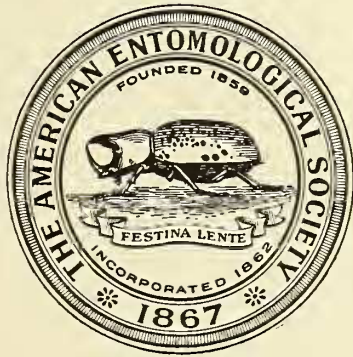


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NUMBER 15

THE NEOTROPICAL SPECIES
OF THE
“SUBGENUS AESCHNA”
SENSU SELYSII 1883
(ODONATA)

BY
PHILIP P. CALVERT



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To My Beloved Wife,

Amelia Smith Calvert,

Whose love, sympathy and aid in countless ways

Has made this work possible.

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THE NEOTROPICAL SPECIES OF THE
"SUBGENUS AESCHNA" SENSU SELYSII 1883
(ODONATA)

BY PHILIP P. CALVERT

*Zoological Laboratory, University of Pennsylvania,
and Academy of Natural Sciences of Philadelphia*

(Illustrations by Elsie Lincoln Rosner, Eleanor Bareiss,
Grace Eager, Leonard M. Pakman and Philip P. Calvert.)

OBJECT OF PAPER: SOURCES OF MATERIAL

This paper aims to present an account of the neotropical species referred by de Selys in 1883 to his subgenus *Aeschna*, together with some species unknown to him. His subgenus is here divided into three genera, *Aeshna*, *Coryphaeschna* and *Castoraeschna*, *Aeshna* in its turn being further subdivided into the subgenera *Aeshna*, *Hesperaeschna*, *Schizuraeschna*, *Marmaraeschna* and *Neureclipsa*, as proposed in Entomological News, 1952, vol. LXIII, pages 253-264.

The material on which this paper is based is in the collections of the Academy of Natural Sciences of Philadelphia (abbreviated ANSP), thanks to the late Dr. Henry Skinner and to Mr. J. A. G. Rehn, including that of Dr. Charles C. Adams, presented by him to the Academy, that of the writer, and in the following institutions:

The Museum of Comparative Zoology, Cambridge, Massachusetts (MCZ), loaned originally by the late Samuel Henshaw, director.

The United States National Museum, Washington (USNM), loaned originally by the late L. O. Howard, U. S. Entomologist, the late Mr. W. H. Ashmead and sent by the late Mr. Rolla P. Currie.

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I. ADULTS

Genus AESHNA

1775. *Aeshna* Fabricius, *Systema Entom.*, p. 424, and subsequent works up to and including 1798. *Suppl. Entom. Syst.* ii, pp. vii, 383.

Preliminary References

1634. Moufet, T., *Insectorum sive Minimorum Animalium Theatrum*. London, T. Cotes, p. 69.
1658. Id., *The Theater of Insects* in Edward Topsell's *History of Four-footed Beasts*. London, E. C., p. 943.
1668. Charleton, W., *Onomasticon Zoicon*. London, Allestry, p. 41.*

* Hagen, 1840, *Syn. Lib. Eur.* p. 3 (translated) says of the passage in Moufet 1634, p. 69, "Under the name of *Aeschna* he mentions certain mayflies (Ephemeras)". Both Moufet and Charleton use the same words in describing *Aeschna*; Hagen's remark applies therefore to Charleton also. Moufet, 1634, p. 64, 1658, p. 939, describes "what the English call adders boules, dragonflies and water butterflies" under the names *Mullei*, *Pavones* and *Libellae*; Charleton, p. 39, as *Perla*, *Libella* and *Zygaena*.

Postlinnean References, Chronologically Arranged

1798. Cuvier, Tableau Elem. Hist. Nat. Anim., pp. 475, 476.
1798. *Aeshna* Illiger, in Kugelaan, Verzeichn. Kafer Preussens, p. 500.
1799. Fabr. Suppl. Entom. Syst. Index Alphabeticus, p. 5.—1801. Illiger, Mag. Insektk. I: 126.
1840. *Aeshna* Westwood, Syn. Gen. Brit. Ins. in Introduction Mod. Classif. Ins. p. 47 (First designation of "typical species"; *grandis* Linn.)
1883. *Aeschna* Selys, Bull. Acad. Roy. Belg. (3) 5 (6): 728-729.—1903. Williamson, Ent. News 14 (1): 2, 5-7.
1905. *Aeshna* Calvert, Biol. Centr.-Amer. Neur. pp. 175, 179.
1908. *Aeschna* Martin, Coll. Zool. Selys, fasc. xviii: 33.—1909. Foerster, Jahrb. Nassau. Ver. Naturk. Wiesbaden 62: 218, 220.
1911. *Aeshna*, Internat. Comm. Zool. Nomencl. Opinion 34, Smithson. Inst. Publ. 2013, p. 79.—1913 Cockerell, Proc. U. S. Nat. Mus. 45: 581.
1918. *Aeschna* Ris, Arch. Naturgesch. 82 (A, 9): 156.—1923. Götz, Mitt. Munchen. Ent. Gesell. 13: 38.—1925. Kruger, Abhd. Ber. Pommersch. Naturfor. Ges. 6: 79.—1929. Schmidt in Brohmer, Ehrmann u. Ulmer, Die Tierwelt Mitteleuropas 4: 33.—1929. Needham & Heywood, Hdbk. Dragfls. N. Amer.: 124, 125, 134.—1930. Needham, Man. Dragfls. China: 70, 71, 90.—1930. Bartenef, Zool. Anz. 89 (1-2): 39.
1936. *Aeshna* Fraser, Fauna Brit. India, Odon. 3: 123.—1946. Fletcher, Jl. Soc. Brit. Ent. 3 (1): 32.—1949. Fraser, Hdbk. Ident. Brit. Ins. Roy. Ent. Soc. Lond. 1 (10): 34.—1951. Pinhey, Transvaal Mus. Mem. 5: 162, 163.

All the above, selected, references to *Aeshna* or *Aeschna* deal with this genus as of a wider scope (sensus) than that here treated; after each reference, therefore, the words "in part" should be understood.

The type species (generotype) of Aeshna (Aeschna).

In establishing the genus *Aeshna* in 1775, Fabricius listed under it these four species and in the following order: *forcipata* L., *grandis* L., *variegata* F. and *clavata* F. These four species only are listed under *Aeshna* by Fabricius in his 1781 Species Insectorum, pp. 525-526. In his 1787 Mantissa Insectorum, p. 339, he added to these four a new species, *minuta*; in both the Species of 1781 and the Mantissa of 1787, the fourth species is spelled *clauata*. In his 1793 Entomologia Systematica, Vol. II, pp. 383-385, the same five species of *Aeshna* are listed and in the 1798 Supplementum thereto, pp. 385-6, *Aeshna heros* and *annulata* are added.

These data from Fabricius make it evident that the fixation of *junceae* L. as the type of *Aeschna* (or *Aeshna*) by de Selys in 1883; by Jacobson & Bianchi in 1905 (Orthop. & Pseudoneur. Russian Emp. p.

763); by Muttkowski 1910 (Bull. Publ. Mus. City Milwaukee I (1): 108); and by Fraser 1922 (Jl. Bombay Nat. Hist. Soc. 28 (2): 485) and 1936, is invalidated by the International Rules of Zoological Nomenclature Article 30 IIe α : "The following species are excluded from consideration in determining the types of genera. Species which were not included under the generic name at the time of its original publication."

Malaise 1938 (Ent. Tidskrift, Haft 3-4: 99) has argued that when Fabricius "in his later works, . . . wanted to specially distinguish a certain species as the one where the character of the genus was most clear, or in our words most typical, he improved the structural description of the genus and that of the species by adding to the latter a description of the mouth parts." By "later works" of Fabricius, Malaise evidently meant the later "Systemas", since he expressly calls the 1792-4 Entomologia Systematica earlier. The later Systemas are not concerned with the Odonata, so that any generotype designations for Odonata by Fabricius must be sought in his earlier works from the 1775 Systema Entomologiae to the 1792-99 Entomologia Systematica, its Supplementum and Index. The following statements apply only to the Odonata, not to other groups of insects, and the terms Odonate, Odonata, are here used only for present day convenience, not as quoted from, or employed in, the works discussed.

In the 1775 Systema Entomologiae the differences between the three genera *Libellula*, *Aeshna* and *Agrion* were based solely on characters of the labium; the descriptions of the two new species of *Aeshna*, *variegata* and *clavata*, are longer than the descriptions of the two Linnean species, *forcipata* and *grandis*, and do not mention the mouth parts. In the 1776 or 1777 Genera Insectorum the generic characters are amplified from other organs, but no specific descriptions are given under *Libellula* or *Aeshna*. In the 1781 Species Insectorum no generic characters are given; the descriptions of new species (6 *Libellula*, 1 *Agrion*, 0 *Aeshna*) are longer than those of other species but do not include the mouth parts. In the 1787 Mantissa Insectorum a new species of *Aeshna*, *minuta*, is described at greater length than the other species of the genus, but no mention is made of its mouth parts. The descriptions of new species in the 1793 Entomologia Systematica Vol. II and the 1798 Supplementum are not always longer

than those of other species and do not include the mouth parts. It follows that Malaise's method of determining Fabricius's generotypes does not serve for the Odonata.

Works published subsequently to those of Fabricius above cited deal with species of *Aeshna* as follows:

Cuvier 1798 mentions only *grandis* under *Aeshna*, to which de Selys called attention (1890 *Compte Rendu Soc. Ent. Belg.* IV (10): clx, clxi).

Latreille 1802, *Hist. Nat. Crust. & Ins.* III: 286, mentions *forcipata* as the single "exemple" under *Aeshna* and in XIII: 6-8, 1805, lists the following five species of that genus: *annulata*, *grandis*, *maculatissima*, *mixta* and *forcipata*.

Latreille 1803, article *Aeshne* in *Nouveau Dictionnaire d'Hist. Nat. chez Deterville Paris* I: 115-117, described two species of *Aeshna*, *grandis* Fab. and *forcipata* Fab. (sic).

Latreille 1804, *Tableau Methodique des Insectes*, Tome 24 of the same *Dictionnaire*, p. 170, mentions no species under *Libellula*, *Aeshna* and *Agrion*. In this *Dictionnaire* articles are signed at the end of each with only the initial letter of the author's name; a key to these initials is given on page xlv of Tome I.

Latreille 1807, *Genera Crust. & Ins.* III: 179-183, mentions *forcipata* F. and *annulata* Latr. under the genus *Aeshna* Fabr.

Latreille 1810, *Considerations Generales sur l'ordre naturel*, in the section "Tableau methodique des genres", pp. 88-420, mentions no species under the three odonate genera on p. 272; in the section "Tableau des genres avec l'indication de l'espece qui leur sert de type", *Libellula 4-maculata* Fab. is the type of *Libellula*, *Aeschna forcipata* Fab. the type of *Aeschna* and *Agrion virgo* Fab. the type of *Agrion*, page 434. It is interesting to note that the spelling is *Aeshna* on page 272, *Aeschna* on page 434.

Latreille 1817, *Crust. Arach. & Ins.* in Cuvier's *Regne Animal* III: 424-6, gives only the following species under the three Odonate genera: *depressa* Lin. under *Libellula*, *grandis* Lin. under *Aeshna*, *virgo* Lin. and *puella* Lin. under *Agrion*. With respect to the species in this volume, Latreille says (translated) "Having been able to describe only a small number of species, I have chosen the most common and the most interesting, particularly those which are mentioned in

the tableau elementaire de l'histoire naturelle des animaux of M. Cuvier" (Avertissement, p. xij).

Latreille 1829. In the new (second) edition of the *Regne Animal* the same four species of Odonata are given under the same three genera (Tome V: 239-240).

Of the above-cited works of Cuvier and of Latreille, the only one which mentions species as types of genera is that of Latreille 1810. Latreille gives species as "exemples" of genera in the third volume of his *Histoire Naturelle Generale et Particuliere* of 1802, pages 286-7. Cuvier 1798 and Latreille's works of 1803, 1804, 1807, 1817 and 1829 give neither "exemples" nor "types" of genera. A remark by Latreille "*l'Ae forcipata* pourrait former un autre sousgenre" (1929 *Regne Animal* V: 240, footnote to *Ae. grandis*) may indicate the slight importance in which he held his 1810 designations of types, since he makes no defence of the type nature of *forcipata*.

According to the combined data given by Hagen (1840 *Syn. Libel. Europ.* pp. 48-49, and 1844, *Stettiner Ent. Zeit.* 5: 257-262) and de Selys (1850 *Revue des Odonates de l'Europe* pp. 83-84) the *Aeshna forcipata* of Latreille 1805 *Hist. Nat. Crust. & Ins.* 13: 8—not 9—No. 5 and 1807 *Genera Crust. & Ins.* 3: 182 is a synonym of *Libellula vulgatissimus* Linnaeus and not the same species as *forcipata* Linnaeus. This synonymy is also to be found in Kirby's 1890 *Catalogue of the Odonata* pp. 67 and 58 under *vulgatissimus* and *forcipata* respectively. If *forcipata* in Latreille 1810 is the same species as in Latreille 1805 and Latreille 1807, *vulgatissimus* Linn., not having been included in *Aeshna* when this genus was established by Fabricius in 1775, its synonym *forcipata* Latreille is ineligible as the generotype of *Aeshna* Fabricius.

J. O. Westwood 1840, *Synopsis of the Genera of British Insects* (separately paged appendix to vol. 2 of his *Introduction to the Modern Classification of Insects*) has this footnote to page 1: "Throughout this Synopsis, the first line of each genus comprises the following particulars:—1. Name of the genus; 2. name of its founder; 3. synonyms of the genus; 4. author of the synonymical genus; 5. number of British species; 6. typical species; 7. reference to the best figure; this last item being occasionally, for want of space, placed after the description of the genus." In correspondence with this footnote we read on page 47:

"*Aeshna* Fabr. *Libellula* p. Linn. 7 sp. *L. grandis* Linn. Donovan. 337 f. 2." It would appear, therefore, that Westwood was the first to definitely fix the type of *Aeshna*, and as *grandis* Linn., owing to the ineligibility of Latreille's 1810 fixation of *forcipata*, as stated in the preceding paragraph.

Cowley 1934 (*Entomologist* 67: 249-250) designated *grandis* Linn. as the generotype of *Aeshna* Fabricius, a conclusion with which both Needham 1897 (*Canadian Ent.* 29: 165, footnote) on different (Cowley says "mistaken") grounds and I agree. I have thought it well to restate the whole question here, with fuller references; perhaps I too have overlooked some. I have personally examined all the references quoted above.

Edmond de Selys-Longchamps, in his *Synopsis des Aeschnines*, *Première Partie: Classification* of 1883 divided this subfamily into five genera, *Anax*, *Aeshna*, *Telephlebia*, *Gynacantha* and *Staurophlebia*. The genus *Aeshna* in turn was divided into 13 subgenera, one of which was *Aeshna*. The neotropical species of his subgenus *Aeshna* form the subject of this present paper. The characters which de Selys assigned to his subgenus *Aeshna* Fabricius were (translated): Wings quite wide, with moderately dense reticulation, generally pointed at the apex; discoidal triangles long, with 3-5 cells; internal triangles free or of 2 cells; median (submedian) and hypertrigonal spaces crossed by several veins, the hypertrigonal very rarely free; basilar (median) space free; subnodal sector (*Rs* of Comstock & Needham) two-forked, in general at the level of the pterostigma or a little in front thereof; pterostigma long or short; membranule moderate or large.

Eyes contiguous; frons moderately rounded, viewed from above; occipital triangle small or moderate.

Abdomen subcylindrical, more or less constricted at the third segment, especially in the male.

Males with the anal margin (of the hind wings) excavated at a right angle; anal triangle long, narrow, divided into 2 or 3 cells; anal appendages large or moderate, sub lanceolate, the inferior subtriangular or a little truncate at apex.

Females with the margin of the tenth abdominal almost rounded, below subdenticulate or spinous; anal appendages variable.

Distribution cosmopolitan; more than 50 species, which is a third of the Aeschnines now known (De Selys, pp. 728-729).

Thirty-eight of these species are listed under *Aeschna* in Kirby's Catalogue of the Neuroptera Odonata of 1890, pp. 86-90.

To these Selysian characters of the subgenus *Aeschna*, Karsch, in his Kritik des Systems der Aeschniden added (translated): Upper sector of the arcus [M1-M2-M3, Comstock & Needham] arising at the middle thereof, supplementary sector [Rspl, Ris] between the median [M3, C&N] and subnodal sectors [Rs] so strongly curved that between it and the subnodal 3-7 rows of cells find place (Karsch p. 277).

René Martin in two treatments of the Aeschnines of the world combined most (not all) of the characters employed by de Selys and by Karsch. He enumerated 51 and 58 species respectively. Martin and other authors have regarded the Selysian subgenera as genera.

Even earlier than 1883 de Selys had considered the dismemberment of his subgenus *Aeschna*, as indicated by Cabot.*

The first decisive step in dividing the American species of de Selys' *Aeschna* was taken in 1903 by E. B. Williamson in establishing the genus *Coryphaeschna* for *Ae. ingens*, *adnexa* and *virens*. From this point on we may consider the subdivisions of neotropical *Aeschna* Selys 1883 as seem warranted by the present study.

KEY TO NEOTROPICAL GENERA, SUBGENERA, SPECIES AND SUBSPECIES OF THE "SOUS-GENRE *AESCHNA*" SELYS 1883

This key is based fundamentally on venational characters, as being common (with few exceptions) to both sexes. These characters, as here used, vary, although usually to less than 20 percent or at most 30 percent. Therefore, in using this key, one should take into consideration the sum total of the four venational characters, supratrangulars, internal triangle, discoidal triangle and anal loop, associated together. In doubtful specimens a majority of these four will usually lead to a correct identification. Tables 6-19 of venational details will aid here.

This key is based also on well- or fully-colored specimens. Faded examples often fail to show a feature given in a leading rubric; this is especially true for those sections of the key beginning at rubrics 9 and 22. The suggestion of Mrs. L. K. Gloyd (1940, Occas. Papers Mus.

* Mem. Mus. Comp. Zool. Harvard Coll. VIII (1), p. 26, lines 19-22, 1881. The text of this article is believed to have been written by Dr. H. A. Hagen.

Zool. Univ. Mich. 415, p. 6, footnote) that "If the surface is brushed with 85-95 per cent alcohol, the true pattern will be visible for a few seconds" may be used here with good results. Faded insects may not show the pale antehumeral stripe or spot and hence the user of this key may place such with unsatisfactory results. In this, as in all cases, one must be guided by a consideration of the sum total of characters leading through one or more rubrics to a given species. The penis has been figured for the majority of the species. Its structure and the nomenclature of its parts, following the numeration of Borror (1942, Revis. Erythrodiplax, p. 16), are shown in our figures 10, plate I, and 365, plate XXVII. It does not differ specifically, but the fourth segment, or glans, furnishes generic characters not hitherto utilized.

- 1 Subnodal sector (Rs) forking proximal to the level of the stigma, with 3 or more rows of cells between the fork at the level of the distal end of the stigma; proximal side of discoidal triangle of hind wings usually, but not always, longer than half the length of the hind (posterior) side; males with each postero-ventral tergal angle of abdominal segment 1 *not* produced into a mesad-projecting tooth, glans penis bifid at apex with no terminal median projection

Genus *Aeshna* 2

- 1a Subnodal sector (Rs) forking at the level of from half of the last postnodal costal cell to that of three postnodal costal cells proximal to the stigma, or more rarely at the level of the proximal end of the stigma, with 3 or 4, rarely 2 rows of cells between the fork at the level of the distal end of the stigma; proximal side of discoidal triangle of hind wing always shorter than half the length of the hind side; males with each postero-ventral tergal angle of abdominal segment 1 prolonged into an acute mesad-projecting tooth, glans penis with a thread-like central dorsal cornu

Genus *Castoraeschna* 31

- 1b Subnodal sector (Rs) forking under the stigma or at the level of its proximal end, with 2 rows of cells between the fork at the level of the distal end of the stigma; proximal side of discoidal triangle of hind wing usually, but not always shorter than half the length of the hind side; males with each postero-ventral tergal angle of abdominal segment 1 *not* produced into a mesad-projecting tooth, glans penis not as in 1

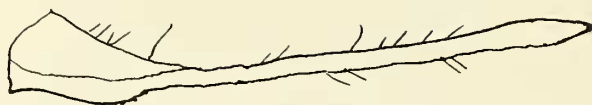
Genus *Coryphaeschna* 25

- 2(1) Abdominal segment 1 with no ventral tubercle, point of beginning of two rows of cells between M1 and M2 variable

Subgenus *Aeshna* 3

- 2a(1) Abdominal segment 1 with a ventral tubercle bearing spinules or hairs or both; males with a mid-dorsal longitudinal carina on abdominal segment 10 and hind wing with anal triangle 3-celled 4
- 3 Thorax dull green, pale markings of the abdomen green, abdominal appendages as long as abdominal segments 9+10, abdomen (incl. apps.) 57 mm., hind wing 50 mm., its maximum width 11 mm. ♀ only
Ae. unicolor Martin
- 3a(2) Thorax rust-colored, its sides feebly greenish without markings, pale markings of the abdomen rust-colored, abdominal appendages as long as abdominal segment 10, abdomen (incl. apps.) 48 mm., hind wing 52 mm., its maximum width 16.5 mm. ♀ only
Ae. rufipes Ris
- 4(2a) Supratrangular cross-veins present 5
- 4a(2a) Supratrangular cross-veins absent; point of beginning of two rows of cells between M1 and M2 under the distal half or distal end of the stigma or distal to the stigma; anal loop of hind wing with two vertical rows of cells; superior appendages of males with an inferior subbasal tooth Subgenus *Neureclipta* 22
- 5(4) Thorax (pterothorax) with two oblique pale lateral stripes (broken into spots in *biliosa*) 6
- 5a(4) Thorax (pterothorax) pale with scattered black lateral marks; point of beginning of two rows of cells between M1 and M2 proximal to the level of the stigma or under the proximal end, or under the proximal half, of the stigma Subgenus *Marmaraeschna* 21
- 6(5) Males with superior appendages in lateral edge view not bifid at apex, nor with an anteapical inferior point as in *Sch. dugesi*; point of beginning of two rows of cells between M1 and M2 variable
Subgenus *Hesperaeschna* 7
- 6a(5) Males with superior appendages in lateral edge view bifid in apical fourth or less, the lower division much shorter than the upper and in one species (*dugesi*) reduced to an inferior anteapical point; both sexes with two rows of cells between M1 and M2 beginning distal to the level of the stigma or under the distal end thereof
Subgenus *Schizuraeschna* 20
- 7(6) Venation less dense, not more than 3 rows of cells between the fork of Rs under the stigma or, if more than 3 rows the pale antehumeral stripes well developed 8
- 7a(6) Venation more dense, more than 3 rows of cells between the fork of Rs under the stigma 18
- 8(7) Anal loop of hind wing with 2 vertical rows of cells; pale antehumeral stripes absent, male superior appendages with an inferior subbasal tooth *H. californica* Calvert
- 8a(7) Anal loop of hind wing with 3 vertical rows of cells; pale antehumeral stripes present 9

- 9(8a) Pale antehumeral stripes nearly as long as the mesepisternum 10
- 9a(8a) Pale antehumeral stripe occupying the lower half only, or less, of the mesepisternum as a short stripe or spot 15
- 9b(8a) Pale antehumeral stripe represented by a short inferior stripe in less than the lower half of the mesepisternum and a small spot in front of the antealar sinus; male superior appendages with an elongated basal inferior tubercle, genital lobe of male prominent 17
- 9c(8a) Pale antehumeral and lateral thoracic stripes and pale color on abdominal sternites not recognizable in the types, no other specimens known; male superior appendages with no basal or subbasal inferior tubercle, apices curved dorsad
- Subgenus (?) and species *Rhionaeschna maita* Foerster
- 10(9) Pale area on each side of the dark stem of the T-spot of frons wider than the stem; pale mesepimeral stripe with two concavities on its anterior margin; anterior lamina of male with spines .4 mm. long; anal appendages of female 2.86-3.5 mm. long *H. haarupi* Ris
- 10a(9) Pale (usually yellow) area on each side of the dark stem of T-spot of frons narrower than the stem 11
- 11(10a) Pale mesepimeral stripe almost straight in at least the lower 6/7 of its course; male superior appendages with no inferior subbasal tooth or tubercle, or this rudimentary 12
- 11a(10a) Pale mesepimeral stripe at least a little curved (sinuous) 13
- 12(11) Pale thoracic stripes wider (antehumeral maximum 1.3-2. mm.), inner margin of male superior appendages convex throughout distal 2/3 of appendage length, female anal appendages triangular, 1.13 mm. long, shorter than abdominal segment 10 *H. williamsoniana* Calvert
- 12a(11) Pale thoracic stripes narrower (antehumeral maximum .5 mm.), inner margin of male superior appendages slightly or not concave on distal half of appendage length, female anal appendages elongate-lanceolate 3.76-4.66 mm. long, subequal in length to abdominal segments 9 + 10 *H. confusa* Rambur
- 13(11a) Mes- and met-epimeral stripes not, or but slightly constricted on their anterior margin 14
- 13a(11a) Mes- and met-epimeral stripes constricted by a deep sinus or indentation, usually deeper than wide, on the anterior margin, male superior appendages with no inferior subbasal tooth, female anal appendages 3.44-5.15 mm. long *H. cornigera planaltica* Calvert
- 14(13) Anterior lamina of male with spines .5-.8 mm. long, female anal appendages 3.44-6.80 mm. long *H. cornigera cornigera* Brauer
- 14a(13) Anterior lamina of male with rudimentary spines .09-.14 mm. long, female anal appendages 7.28-8.26 mm. long *H. psilus* Calvert
- 15(9a) Pale mesepimeral stripe reaching to the upper margin of its sclerite .. 16
- 15a(9a) Pale mesepimeral stripe reaching only part (3/4-2/3) way to upper margin of its sclerite, anterior lamina of male with spines .85 mm. long, female anal appendages 3.27-4.17 mm. long ... *H. peralta* Ris



BREVIFRONS



INTRICATA



VIGINTIPUNCTATA

Edge views of the left superior appendage of males of *Ae. (Marmaraeschna)* *brevifrons* (Arequipa, Peru, Oct. 28, 1898), *intricata* Tarma, Peru, May 31, 1920, f), and *vigintipunctata* (Coroico, Bolivia, May 23, 1899).

- 16(15) Anterior lamina of male with spines .67-.94 mm. long, female anal appendages 4.75-4.91 mm. long *H. marchali* Rambur
- 16a(15) Anterior lamina of male without spines, female anal appendages 10 mm. long (estimated Wllmsns.) *H. manni* Wllmsns.
- 17(9b) Pale mesepimeral stripe broken into three spots, one above another
H. biliosa Kennedy
- 17a(9b) Pale mesepimeral stripe not broken into spots (a deep excision on the anterior margin at two-thirds height corresponds to the interval between the uppermost and the middle spots of *biliosa*)
H. joannisi Martin
- 18(7a) Pale antehumeral stripe occupying the middle 3/5 of the length of the mesepisternum, pale mesepimeral stripe reaching to the upper end of its sclerite 19
- 18a(7a) Pale antehumeral stripe absent, pale mesepimeral stripe reaching only part ($\frac{1}{2}$ - $\frac{3}{4}$) way to the upper end of its sclerite, anterior lamina of male with spines .65-.98 mm. long, anal appendages of 1 ♀ 4.58 mm. long *H. variegata* Fabricius
- 19(18) Face pale blue or green, anterior lamina of male with well-developed spines, female anal appendages 5.65-6.71 mm. long
H. punctata Martin
- 19a(18) Face chrome orange, anterior lamina of male without spines, female unknown *H. decessus* Calvert

- 20(6a) Male superior appendages with apical fork in profile view .21-.26 as long as appendage length, with inferior subbasal tubercle at $\frac{1}{4}$ - $\frac{1}{5}$ of appendage length, height of superior carina above outer margin in profile view not less than the depth of appendage directly below it, female anal appendages 5.56-5.89 mm. long
Sch. multicolor Hagen
- 20a(6a) Male superior appendages with apical fork in profile view .22 as long as appendage length, with inferior subbasal tubercle at $\frac{1}{6}$ -.8 of appendage length, height of superior carina above outer margin in profile view less than the depth of appendage directly below it, female anal appendages 5.97-7.04 mm. . . *Sch. jalapensis* Williamson
- 20b(6a) Male superior appendages not forked at apex, lower branch of fork of the other species represented by an inferior angle at .16-.26 of appendage length from apex, with inferior subbasal tubercle at .12-.15 of appendage length, height of superior carina above outer margin in profile view (fig. 192), but not in edge view (fig. 193), much less than the depth of appendage directly below it, female anal appendages 6 mm. long *Sch. dugesi* Calvert
- 21(5a) Male superior appendages in edge view without a superior longitudinal carina, with an inferior low swelling reaching its maximum at $\frac{1}{4}$ of appendage length, thence decreasing gradually caudad; black spots on the pterothorax fewer, always absent from the upper half of the mesepimeron; more often (90%) only one cell on the proximal side of discoidal triangle of front wing; discoidal triangle of hind wing with fewer than four cells; female anal appendages 1.50-2.78 mm. long *M. brevifrons* Hagen
- 21a(5a) Male superior appendages in edge view with an arched superior longitudinal carina in the terminal .2-.4 of the appendage length, with an inferior tubercle at $\frac{1}{4}$ of the appendage length, terminating more abruptly caudad than in *brevifrons* but its posterior margin convex; black spots on the pterothorax more numerous, always present on the upper half of the mesepimeron; more often (94%) 2 cells on the proximal side of discoidal triangle of front wing; female anal appendages 1.47-2.86 mm. long *M. intricata* Martin
- 21b(5a) Male superior appendages in edge view * with an arched superior longitudinal carina in the terminal $\frac{1}{4}$ - $\frac{1}{3}$ of the appendage length, with an inferior tubercle much as in *intricata*, but its posterior margin distinctly angular; black spots on the pterothorax more numerous, always present on the upper half of the mesepimeron; 2 cells (100%) on the proximal side of discoidal triangle of front and hind wings; discoidal triangle of hind wings more often (83%) with 4

* Figs. 478 and 483, plate XXXVI are *profile*, not edge views and do not show

cells; female anal appendages 2.78-6.38 mm. long

M. vigintipunctata Ris

- 21c(5a) Male unknown *M. pallipes* Fraser
- 22(4a) Pale mesepimeral stripe reaching to the upper margins of mesepimeron and metepisternum, nearly straight 23
- 22a(4a) Pale mesepimeral stripe reaching upward to $\frac{3}{4}$ length or less of the mesepimeron and metepisternum; fronto-nasal suture with or without a black line; membranule of hind wing with at least its basal third white; apex of male superior appendages in dorsal view acute to obtuse *N. diffinis diffinis* Rambur
- 22b(4a) Pale mesepimeral stripe represented only by small crescentic yellow spot * at its lower end; fronto-nasal suture with a pale brown line; membranule of hind wing with extreme base (about $\frac{1}{6}$) white; apex of male superior appendages in dorsal view obtuse
N. elsia Calvert
- 22c(4a) Pale mes- and met-epimeral stripes absent from all material seen or described; fronto-nasal suture with no dark line; membranule of hind wing with its basal $\frac{1}{4}$ - $\frac{1}{3}$ white; apex of male superior appendages in dorsal view typically obtuse ... *N. galapagoensis* Currie
- 23(22) Mesepimeral stripe yellow, .41-.90 mm. wide at mid-height 24
- 23a(22) Mesepimeral stripe bluish-white, 1.23 mm. wide at mid-height, ending inferiorly in a yellow spot *N. elsia* Calvert †
- 24(23) Membranule of hind wing with only the extreme base white; fronto-nasal suture with no complete black line; pterostigma unicolorous; apex of male superior appendages in dorsal view obtuse
N. bonariensis Rambur

the superior longitudinal carina. By edge view is meant the view obtained when the superior appendage is in such position that its inner (mesal) and outer (lateral) margins lie in approximately the same plane, or, in other words, the transverse diameter of the upper surface of the appendage lies in the observer's line of vision. Edge view differs from profile view in that the latter term has been frequently applied to the view obtained when the two superior appendages lie in the same plane and the insect is viewed from the side; in such a profile view the upper surface of each appendage usually lies in a plane oblique to the observer's line of vision.

* The convex edge of this crescentic yellow spot corresponds to the lower edge of the fully developed mesepimeral stripe of other species.

† In this key *elsia* has been entered twice, first under rubric 22b when, as is more frequently the case in the specimens examined, most of the mesepimeral stripe has faded, second under rubric 23a when this stripe is well preserved.

- 24a(23) Membranule of hind wing with basal $1/5-1/7$ white; apex of male superior appendages in dorsal view acute
N. diffinis absoluta Calvert
- 25(1b) Thorax with well-marked brown bands at the mid-dorsal carina, the humeral and second lateral sutures; abdomen chiefly dark brown or black; the superior transverse curved groove on the anterior surface of the frons usually not black; male inferior appendage reaching to mid-length of the superiors (broken in the one known *secreta*) 26
- 25a(1b) Thorax with no brown markings or these reduced to lines 29
- 26(25) Male superior appendages excised on the inner margin 27
- 26a(25) Male superior appendages not excised 28
- 27(26) Male superior appendages with a deep excision on the inner (mesal) margin at $3/4$ their length, in profile view apex truncated obliquely, or roundly, from above ventrad and slightly cephalad; female anal appendages entire, very short, 1.5 mm. long
Co. luteipennis Burmeister
- 27a(26) Male superior appendages with a deep excision on the inner margin at $2/3$ their length, in profile view apex tapering to a fairly acute point which is bent ventrad; female anal appendages entire, very short, .98 mm. long *Co. rufipennis* Kennedy
- 28(26a) Male abdomen (excl. apps.) 51 mm., hind wing 47 mm. long, female unknown *Co. secreta* Calvert
- 28a(26a) Male abdomen (excl. apps.) 58-61 mm., hind wing 55-65 mm., female anal appendages very long, 12.5-13. mm., longer than abd. segs. 8 + 9 + 10 *Co. ingens* Rambur
- 29(25a) Frons with a black T-spot superiorly, abdomen chiefly dark brown or black 30
- 29a(25a) Frons with no black T-spot superiorly; face, thorax and abdomen chiefly reddish; male inferior appendage reaching to mid-length of superior appendages *Co. perrensi* McLachlan
- 30(29) Size larger, abdomen (excl. apps.) male 50-57, female 54-64 mm.; face bright green, the superior transverse curved groove on the anterior surface of frons usually not black or dark brown; male inferior appendage reaching to about $3/5$ of length of superior appendages
Co. viriditas Calvert
- 30a(29) Size smaller, abdomen (excl. apps.) male 44-46, female 47-48 mm.; face bright blue (male) or green (female), the black T-spot of the frons extending on to the anterior surface and filling the superior transverse curved groove thereon, except in Mexican examples; male inferior appendage reaching to .36-.4 of length of superior appendages *Co. adnexa* Hagen

- 31(1a) Only a narrow transverse brown line at the junction of the dorsal and anterior surfaces of the frons representing the head of the T-spot, no stem; male superior appendages with an inferior subbasal tubercle and latero-ventral tergal processes of abd. segment 1 not denticulated at apex; postero-dorsal pale spots present on abdominal segments 2-10; female anal appendages 1.38-1.64 mm. long.
Castoraeschna januaria (Hagen)
- 31a(1a) Head of T-spot present, stem absent; male superior appendages with no inferior subbasal tubercle or tooth and latero-ventral tergal processes of abd. segment 1 not denticulated at apex; females unknown 32
- 31b(1a) Head and stem of T-spot of frons both present, stem triangular, wider anteriorly; male superior appendages with an inferior subbasal tubercle or tooth 33
- 32(31a) Postero-dorsal pale spots well developed on abdominal segments 2-10; male superior appendages rounded, not acute, at apex in either dorsal or profile view; 4 rows of cells between the fork of Rs under the stigma *Ca. longfieldae* (Krimmins)
- 32a(31a) Postero-dorsal pale spots reduced to narrow transverse stripes on abdominal segments 4-8, vestigial or absent on 9 and 10; male superior appendages in dorsal view with the apex truncated from within outward so that the distal lateral angle is acute, in profile view apex acute; 3 or 2 rows of cells between the fork of Rs under the stigma *Ca. coronata* (Ris)
- 33(31b) Pale antehumeral and lateral thoracic stripes relatively narrower, occupying smaller areas of their respective sclerites than in *colorata* (cf. figs. 73, pl. VI and 84, pl. VII); postero-dorsal pale spots well developed on abdominal segments 1-5 of both sexes; postero-ventral tergal processes of abdominal segment 1 of male stouter (.32-.73 as wide as long in profile view), apex not denticulated; size larger, abd. excl. apps. 53-57 mm. ♂, 50-58 ♀, hind wing 50-53 mm. ♂, 51-53 ♀, apps. ♀ 1.06-1.47 mm. *Ca. castor* (Brauer)
- 33a(31b) Pale antehumeral and lateral thoracic stripes relatively wider, occupying larger areas of their respective sclerites than in *castor* (see figs. cited above); postero-dorsal pale spots well developed on abdominal segments 2-10 ♂, 3 or 4-9 ♀; postero-ventral tergal processes of abdominal segment 1 of male more slender (.14 as wide as long in profile view), apex denticulated on its posterior margin, both in profile (fig. 89, pl. VII) and in ventral view; size smaller, abd. excl. apps. 42 mm. ♂, 48 ♀, hind wing 40 mm. ♂, 45 ♀, apps. ♀ 1.2 mm. *Ca. colorata* (Martin)

SOME DETAILS OF ABDOMINAL STRUCTURE

In the palaearctic *Aeshna grandis*, the holarctic, *Ae. juncea*, in *californica* and the neotropical species here referred to the subgenera *Hesperaeschna*, *Schizuraeschna*, *Marmaraeschna* and *Neureclipta*, the ventral margins of the tergum of abdominal 2 of the males, in ventral view, are sinuous, forming between them a three- or two-lobed cavity, the genital fossa. When 3-lobed the posterior boundaries of the lobes are, approximately: for the fore lobe the level of the posterior hamules, for the mid lobe the level of the hind end of the sheath of the penis, for the hind lobe the hind end of the genital lobes; in some species, e.g., *peralta* the point of separation between fore and mid lobes is distinctly angulate. The fore lobe is the widest, its anterior transverse diameter is often much greater than its posterior transverse diameter, its opposite free margins are slightly sinuous or slightly concave and converge caudad more markedly than those of the hind lobe. The mid and hind lobes are much narrower, subequally wide with each other and in some species, e.g., *juncea*, *marchali*, are not always distinguishable from each other, thus producing the bilobed condition.

It is useless to give measurements of these lobes since they vary with the degree of extension of the base of the abdomen at death; the most constant for a given species is the anterior transverse diameter of the fore lobe, e.g., 2.37 mm. *grandis*, 2.13-2.29 *juncea*, .49-1.23 *confusa*, 1.64-2.13 *Schizuraeschna* spp., 1.47-1.8 *Marmaraeschna* spp., 1.25-1.47 *Neureclipta* spp. These measurements can not be used as specific differentials. The lateral boundaries of the hind lobe, alone of the ventral margins of the tergum, are finely denticulated. In the fore lobe lie the anterior lamina, hamular processes and hamular folds, anterior part of the sheath of the penis and under (dorsal to) the sheath the distal end (3rd and 4th segments) of the penis, pl. xxvii, fig. 365, when the latter is at rest. In the hind lobe the first segment, or vesicle, of the penis may be seen, or the vesicle may be partly within, partly behind the hind lobe.

In the intersegmental membrane following each of abdominal segments 1-9, on its lateral surface, is a polished triangular tubercle, behind the posterior, transverse, denticulated carina, directed caudad and reaching to the hind edge of the membrane. This tubercle is between the levels of the postero-dorsal and postero-lateral pale spots, PD and

PL. It is not visible in some examples of the same species. In some species these tubercles are less developed in the female than in the male, e.g., *H. californica*, *haarupi*; they may be absent from segments 1, 2, 3, 7, 8, or 9 and seem not to have specific value.

On each side of the tergum of some or all of abdominal segments 3-9 is an oblique, longitudinal fold or carina, terminating posteriorly at the polished tubercle and lying above the lateral pale spots and below the dorsal pale spots. It is absent from, or less developed in, some females.

There is a pair of shallow dorsal pits on segments 9 and 10 whose exact position is not always easily defined, depending on the degree to which these segments are telescoped; they are nearer to the anterior than to the posterior margin; those on 9 are farther apart than those on 10. They seem to be absent from some females.

On each half of the sternum of segment 11 are two longitudinal carinae converging posteriorly; the lateral of these bears a tooth or tubercle figured for the palaearctic *Ae. mixta* male by Dr. Erich Schmidt 1933, Zool. Anz. 103 (9/10): p. 265, opposite the letters st 11. The tooth or tubercle may be acute, right-angled, obtuse or rounded; it and the carina from which it projects may be dark- or pale-colored; I have not found it in all males nor in some females. In *Schizuraeschna* there is an additional tubercle laterad to that on the carina.

Subgenus **AESHNA** Fabricius sensu stricto

References as for the genus antea pages 2-3.

Subgeneric diagnosis, based on the two following neotropical species the type species, the palaearctic *Ae. grandis* Linn. and two other closely related holarctic (*junceae* Linn.) and palaearctic (*cyanea* Müller) species. Abdominal segment 1 with no ventral tubercle, supratrangular cross-veins present, point of beginning of two rows of cells between M1 and M2 variable; males with a mid-dorsal longitudinal carina on abdominal segment 10, superior appendages in lateral edge view not bifid apically, hind wings with anal triangle 2- or 3-celled.

Aeshna (*Aeshna*) unicolor R. Martin

Tables 6, 9, 12, 14, Pl. XXXIV, figs. 463-6, Pl. XLVI, fig. 603; Map 1.

1908. *Aeshna unicolor* Martin, Coll. Zool. Selys-Longch. fasc. xviii: 55, fig. 52 (apps. ♂) Bolivie, types ♂ ♀ coll. Martin, now in Museum Nationale d'Hist. Nat. Paris.¹*

No material of this species seen by the writer.

♂. From Martin's description¹ translated. Face green, reddish below. Upper surface of frons green with a wide chestnut-colored band in front of the eyes from which projects a chestnut-colored T-spot with a thick stem and a medium head. Occipital triangle extremely small, black.

Thorax dull green. Legs black, femora red.

Abdomen hardly swollen at the 2nd segment, hardly constricted at the 3rd, slender, long, brown, apparently spotted with green on the dorsum and sides of 1 and 2 and two wide spots at the apex of 3-6. The 2nd segment has a black point near the apex on each side of the green spot, 3-6, with the mid-dorsal carina black, 7-10 clouded with black, 10 with a dorsal carina and two small tubercles.

Superior appendages longer than the last two segments, brown, slender at the base, thence widening gradually internally to become spatulate, with no tooth or excrescence other than the usual dorsal carina, apex slightly pointed. Inferior appendage brown, triangular, half as long as the superiors.

Wings pale brown, costa brown, stigma dark brown, slender, very small, membranule entirely greyish brown, a little blacker at apex; discoidal triangle on an average with 4 cells, 4-5 supratrangulars, anal triangle very elongate, 3-celled, abnormally 4-celled; anal angle not prominent, straight; 3-4 rows of cells in the fork of the subnodal which begins notably in front of the stigma; 19-22 antenodals, 11-13 postnodals on the front wings, 12-13 antenodals, 13 postnodals on the hind wings.

♀. Colored like the male, but with the T-spot of the frons almost not indicated, the chestnut color in front of the eyes triangular, remainder of the upper surface of the frons greenish; abdominal segments 1-2 enlarged, no constriction on 3, diminishing progressively in size to the apex. Membranule entirely brownish, hardly paler at base. Appendages brown, foliate, rounded at apex, at least as long as the last two segments.

Abdomen ♂ 58-60, ♀ 57; hind wing ♂ 48, ♀ 50, its maximum width ♂ 8, ♀ 11 mm.

A large species remarkable for its open reticulation, the extreme width of the posttriangular cells, the shape of the abdomen and the length of the female appendages.

* References to literature throughout this paper have been followed by small superior figures, as here. Where corresponding superior figures occur below in the text, they refer back to the reference of the same number.

Type ♂ and ♀ in coll. R. Martin [now in Museum Nationale d'Histoire Naturelle at Paris].

Dr. Erich Schmidt, at my request, examined Martin's types of *unicolor* at Paris, on June 24 and 25, 1951, and kindly sent me the following notes in English. "Ae. *unicolor*: in same box (with punctata Martin) 3 specimens, 2 ♂ 1 ♀; no. 1 ♂ 'A. *unicolor* Martin, Bolivie'; no. 2 ♂ 'Aeschna *unicolor* Martin, Bolivie'; no. 3 ♀ same label as no. 2. No. 2 is in better condition than No. 1, the thorax of the latter being pressed and partly destroyed, therefore I have added a label, written by myself to No. 2: 'Aeschna *unicolor* Martin ♂ Lectotype Erich Schmidt, 22.vi.51.' The T of frons is in the middle part (of No. 1 and of No. 2, lectotype) somewhat indistinctly dark brown, without distinct limitation to the sides. Lectotype ♂ has supratrangular cross veins $\frac{3.5}{3.2}$; anal loop 3.3 vertical rows of cells. No. 1 ♂ supratrangular cross veins $\frac{4.4}{2.2}$; anal loop [sketches from both hind wings show 2 vertical rows]. No. 3 ♀ was not studied. P. S. Ae. *unicolor* ♂ ♂ no ventral tubercle on abd. seg. 1 but some hairs." Dr. Schmidt made the original drawings for our figures 463 and 464 from the ♂ lectotype of Martin.

Prof. Lucien Chopard, of the Paris Museum, kindly sent me the photograph reproduced as our figure 603, plate XLVI; on the back of the photograph is written "lectotype sélectionné par Erich Schmidt le 22.vi.1951".

I am consequently greatly indebted to Dr. Schmidt and to Prof. Chopard for their help with this species.

Aeshna (Aeshna) rufipes Ris

Tables 1, 3, 4, 6, 9, 12, 14; Pl. XXXIV, figs. 454-5; Map 1.

1918. *Aeschna rufipes* Ris, Arch. Naturgesch. 82 Jahrg. Abt. A (9): 167.¹

Colombia, Sosomuco, holotype ♀ in coll. Ris, now presumably in Mus. Senckenberg, Frankfurt am Main.

1947. *Aeschna rufipes* Fraser, Acta Zool. Lilloana 4: 445.²

Material studied.—Peru, La Merced in Chanchamayo, Dr. P. Martin, 1 ♀ no. 3986, det. Cowley, in coll. J. Cowley, Bridgewater, Somerset, England.

The following differences from Ris' description¹ were noted on comparing ♀ no. 3986 with it: Frons somewhat crushed in; eye suture 2.45 mm.; hind margin of the occipital triangle concave; third femur 9.16 mm., third tibia 9.65

mm.; width of thorax 7.5 mm. No ventral tubercle on abd. seg. 1, but at its site (of other species) a transverse band of about 23 black spinules. Membranule not "gross", its free margin 5.24 mm. long. Triangle of front wing costal side 6.21 mm., proximal side 2.45 mm.; of hind wing costal side 5.00 mm., proximal side 2.78 mm.; these measurements confirm Ris's statement¹ pp. 168-9 that *rufipes* is no *Coryphaeschna*, although both Williamson 1903, p. 5, and Ris¹ p. 169 compared the proximal and distal (not proximal and costal) sides of the triangle of the hind wings for proportions in *Coryphaeschna* and *Aeschna*. Lateral plates of ovipositor reaching to .37 of the length of the inflexed tergum of abd. segment 9. Wings almost colorless, costa yellowish, pterostigma cadmium yellow.

♂ unknown.

Subgenus **Hesperaeschna**

1913. *Hesperaeschna* Cockerell, Proc. U. S. Nat. Mus. 45: 581 (generotype *californica* Calvert).

1952. *Hesperaeschna* Calvert, Ent. News 63: 254.

Diagnosis.—Abdominal segment 1 with a ventral tubercle bearing spinules or hairs or both; supratrangular cross-veins present; pterothorax with two oblique pale lateral stripes (broken into spots in *biliosa*); point of beginning of two rows of cells between M1a and M2 variable; males (but rarely in females) with a mid-dorsal longitudinal carina on abdominal segment 10, superior appendages in lateral edge view not bifid at apex, nor with an anteapical ventral point, hind wings with anal triangle 3-celled.

Description of characters common to many species of this subgenus in addition to those given above under diagnosis and not repeated in the specific descriptions. Face and labrum blue or pale green in the males of many species, but chrome lemon in *biliosa*, chromium orange in *decessus*, the females more variable. Fronto-clypeal suture with a pale brown, dark brown or black line, absent in *confusa* female. Upper surface of frons with a median black T-spot, whose details and bordering paler colors differ specifically. Vertex blackish, its tip yellow or green, and with a wide but shallow anterior notch, or the pale tip color extended at the expense of the black. Tibiae most often black or dark brown.

Abdomen swollen at segment 2, constricted at 3, wider on 4-10, uniformly so, or slightly widening from 4 to 10; ground color black or brown, with blue, green or yellow tergal spots here designated as in the schematic diagram of Prof. E. M. Walker, 1912, page 9, fig. 1, plus an additional pale spot on each side behind MD and here designated as PMD, post median dorsal, an addition with which Prof. Walker agrees for neotropical species. In specimens which have preserved their maximum colors the pale spots are as follows: AD on segments 1-10, MD on 1-10, PMD on 3-10, PD on 1-10, AL on 1-10, ML on

1-10, PL on 1-10. Discreteness of these spots is to be understood unless absence or fusion is noted under each species. See our fig. 11, plate I, for some of these spots on segment 6. Ventral inflexed surfaces of the terga pinkish, obscure reddish or pale green (even in the same species, e.g., *variegata*), or the reddish reduced to a longitudinal stripe each side of 4-7. Sterna of 3-9 black, but in some species sterna of 9 behind the parameres* and of 10 bright blue (*confusa*, *cornigera*, *psilus*, *manni*), or pale green or yellow (*variegata*).

For a key to the species of *Hesperaeschna* see antea, pages 10-12.

- Ae. (H.) californica** Tables 1, 3, 4, 6, 9, 12, 14; Pl. V; Map 2.
 1875. *Aeschna californica* Hagen, Proc. Boston Soc. Nat. Hist. XVIII: 33 (no description).¹
 1895. *Aeschna californica* Calvert, Proc. Calif. Acad. Sci. (2) iv: 504, pl. XV, figs. 19, 20 (♂ apps.), 23 (abd. seg. 1 tubercle).²
 1901. *Aeschna californica* Needham & Hart, Bull. Ill. St. Lab. Nat. Hist. 6 (1), pp. 41, 45 (nymphs).³
 1903. *Aeschna californica* Needham, Proc. U. S. Nat. Mus. 26 (1331), pl. XL, fig. 1, (venation ♀).⁴
 1908. *Aeshna californica* Walker, Canad. Ent. 45, pp. 378, 386, 450.⁵
 1908. *Aeschna californica* Cockerell, Ent. News 14 (10), pp. 456-458.⁶
 1909. *Aeschna californica* Martin, Coll. Zool. Selys-Longchamps Cat. Syst. Descr. fasc. XVIII, p. 47, fig. 43 (♂ apps.).⁷
 1911. *Aeschna californica* Martin, Gen. Ins. fasc. 115, p. 11.⁸
 1912. *Aeshna californica* Walker, N. Amer. Dragfls. Genus *Aeshna*, Toronto, pp. 61, 66, 69, 71, 184, pl. 14, fig. 4 (genit. ♂); pl. 17, figs. 4, 4a (apps. ♂); pl. 21, figs. 2, 2a (genit. ♀); pl. 28, figs. 1, 2 (body ♂ ♀).⁹
 1913. *Aeshna californica* Cockerell, Proc. U. S. Nat. Mus. 45 (2000), p. 581 (as type of *Hesperaeschna*).¹⁰
 1915. Kennedy, Proc. U. S. Nat. Mus. 49 (2107), pp. 270, 343.¹¹
 1917. Kennedy, id., 52 (2192), pp. 594-600.¹²
 1927. Seamann, Pomona Coll. Journ. Ent. & Zool. 19, p. 25.¹³
 1929. Ingles, id., 21, p. 28.¹⁴
 1929. *Aeschna californica* Needham & Heywood, Hdbk. Dragfls. N. Amer., pp. 135, 137, 140, fig. (apps. ♂).¹⁵
 1938. Walker, Can. Ent. 70: 144, 145, 147, 149.¹⁶
 1940. LaRivers, Pan-Pacif. Ent. 16 (3), p. 113.¹⁷
 1941. LaRivers, Ent. News 52 (5), p. 128.¹⁸

* I follow A. Machotin in using this term after reading an English translation of his paper Morphologisches Znachenie pridatkov IX abdominalnogo segmenta samtsov Odonata (title of the German summary: Ueber die morphologische Bedeutung der Anhänge des IX Hinterleibes der männlichen Libellen Odonata), Zool. Zhurnal XIII (4) pp. 639-663, 10 figs., 1934. I owe this translation to Miss B. Van Rosen, of Philadelphia. Machotin homologizes each paramere with an outer gonapophysis, or genital valve of the ovipositor, our plate I, figs. 8 and 9 gv.

1948. Whitehouse, Trans. Roy. Canad. Inst. 57, p. 21.¹⁸

1955. Needham & Westfall, Man. Drgfls. N. Amer. (Anisop.) p. 9, fig. 3 head, 10, 290, 294, 296-8, fig. C (labial palp, nymph), 299, fig. 180 (apps. δ).¹⁹

Material studied.—WASHINGTON: Seattle, vii-6-1892, 1 ♀, probably by Prof. O. B. Johnson; * Olympia, June 4, 5, and 19, 1895, 2 ♂, 1 ♀, by Prof. Trevor Kincaid; Sunnyside, July 14, 1912, 1 ♂, May 25, 1913, 3 ♂, 1 ♀, by C. H. Kennedy. CALIFORNIA: Mt. Tamalpais, May 25, 1 ♂, by C. Jack, type of Hagen ANSP No. 9251; Sylvania, 5/13/97, 1 ♂, ex coll. C. C. Adams; San Bernardino, Feb.-March, 1892, 2 ♂, by P. C. Truman; no definite locality, 2 ♂, 6 ♀; 1 ♂ ex coll. Calif. Acad. Sci.; UTAH: Salt Lake City, June, 1893, by A. J. Snyder, 1 ♀; the last female cited in coll. Snyder, all other specimens in coll. ANSP. Total 13 ♂, 10 ♀.

Distribution.—Gulf (now Strait) of Georgia, British Columbia, east to Salt Lake City, Utah,² south to Tombstone, Arizona.³

Altitudinal Range.—Sea-level to 1380 m. (4540 feet).³ Altitudes according to Gannett, H., 1906, A Dictionary of Altitudes in the United States, 4th edition. Lower Sonoran to Transition (and Canadian?) life zones of Merriam by map of Muesebeck & Krombein, 1952, Syst. Zool. 1 (1): 24-25.

♂. Area bordering the stem of the T-spot of the frons pale yellow, which is narrower than the base of the stem but wider than the anterior end thereof, this bordering yellow followed laterad by pale green or blue which is confluent with that of the anterior surface of the frons. Occiput yellow, its two lateral dorsal margins edged with black, hind margin straight. Rear of eyes black.

Pronotum brown. Anterior lobe with an anterior transverse clay yellow line; median lobe bilobed on both anterior and posterior margins but more pronounced anteriorly; hind lobe bilobed on hind margin and with a row of long (2.36-2.45 mm.) white hairs. Propleura clay yellow.

Pterothorax pale brown or luteous, with numerous pale hairs; pale antehumeral stripe absent or very small (2 mm. long), not reaching to the antealar sinus; sides with two oblique bluish or yellowish stripes, margined with black inferiorly; humeral and second lateral stripes each marked with a black line.

Abdominal pale spots: antero-dorsal, AD, on segments 3-6, 7, or 8, larger on 3 than on following segments but much smaller on 7 or 8; medio-dorsal, MD, on 3-7, represented by a dot on 8; postmedian dorsal, PMD, pale brownish; antero-lateral, AL, on 3-6; medio-lateral, ML, behind the accessory transverse suture on 3-8 and which may be confluent with some of the other spots; postero-lateral, PL, on 3-8, confluent with the postero-dorsal, PD, on 3.

Auricles of abdominal segment 2 each with two teeth. Anterior lamina cleft to base, or nearly so, at anterior margin of the genital fossa, reddish brown

* Cf. Ent. News 1917, 28, p. 338.

(dragons blood, Smith's Glossary, pl. IV, 34) to black, the cleft .28-.33 mm. wide, pale luteous, hence contrasting strongly with the lamina on either side; spines almost straight, black, extending caudad to beyond the level of the anterior end of the hamular process or even to the level of mid-length of the hamular lobe. Hamular processes mostly a paler reddish brown than the anterior lamina, their anterior margins blackish, their parallel mesal margins .24-.33 mm. long, acute anteriorly, posteriorly curving away from each other. Hamular lobes slightly shorter than the processes, rounded posteriorly. Posterior hamules with pale hairs not shown in fig. 61, pl. V.

Superior appendages as long as segments 9 + 10, curved somewhat inward and widened more or less gradually on the inner side in the apical half, concave below, above with a median longitudinal carina which is quite sharp and more elevated in the apical fourth, but is not denticulated; margins entire, apex truncated to form an angle of a little more than 90°; maximum width .86-.98 mm., at .55-.66 of appendage length. Viewed in profile, the basal fourth is directed downward, a very slight inferior projection marks a change in direction to the horizontal, while the apical fourth slopes slightly upward.

Inferior appendage a little less than half as long as the superiors, in ventral view triangular, apex rounded, .27-.42 as wide as base, very slightly notched.

Wings clear, costa yellowish to beyond the nodus, or to the stigma, other veins mostly brown, stigma dark brown, surmounting $2\frac{1}{2}$ -3 cells. Membranule white, apical third cinereous.

♀. Differs from the male as follows: Face in some (Washington) pale luteous, distinct from the bluish on the side of the frons. Black stem of the T-spot wider posteriorly in females from Sunnyside and Seattle, area bordering the sides of the black stem pale blue or green in some.

Hairs on pterothorax dark in Seattle example; a small, narrow, isolated, yellow antehumeral spot in some, not all, females from Washington; lateral thoracic stripes bluish and inferiorly yellow, or yellow, or the mesepimeral yellow and the metepimeral only blue (Seattle), a little wider than, or of the same width as, in the male.

Abdominal segment 2 in some with a blue apical spot each side instead of the apical half, spots on 3-8 yellow instead of blue or green; AL present on 3-7 or 8, confluent, or barely confluent with AD; PL confluent with PD on 4 and on 8 in some; PMD on 3-7, decreasing in size caudad; posterior dorsal margin of 10 with many spinules. Genital valves reaching to the apex of 9 or only to $\frac{5}{6}$ of the length of 9. Anal appendages longer than 9 + 10, widening as far as .5-.6 of their length to their maximum width of .82-1.06 mm., thence narrowing to the obtuse apex, outer margin less convex than the inner.

Wings in the Olympia female with a yellow tinge in the anterior half between triangle and stigma. Stigma paler, even bright ochre yellow.

Dimensions.—Total length ♂ 57-61 mm., ♀ 57-60; abdomen (excl. apps.) ♂ 38-46, ♀ 38-45; sup. apps. ♂ 4-5, ♀ 4.75-4.91; hind wing ♂ 33-38, ♀ 37-39; stigma of front wing, costal margin, ♂ 2.86-3.27, ♀ 3.27-3.52. Front wings with 11-15 antenodals, 8-11 postnodals, hind wings with 8-12 ante- and 8-12 post-nodals.

A. californica is not known from the Neotropical Region. It is included here as the type of the subgenus *Hesperaeschna* and for the sake of comparison with the other thirteen known species of the subgenus, all of which are neotropical. *A. californica* occurs at the same localities as *Aeshna* (*Schizuraeschna*) *multicolor* in Washington and California.^{12 13}

Aeshna* (*Hesperaeschna*) *haarupi

Tables 1, 3, 4, 6, 9, 12, 14; Pl. XVIII; Map 1.

1908. *Aeschna haarupi* Ris, Deutsch. ent. Ztschr. 1908, p. 523, fig. 4 (apps. ♂, T-spot, thoracic pattern).¹

1909. *Aeschna haarupi* Martin, Coll. Zool. Selys-Longchamps Cat. Syst. Descr. fasc. XX, p. 212, fig. 219 (apps.).²

1947. *Aeshna haarupi* Calvert, Notulae Naturae Acad. Nat. Sci. Phila. 194, p. 9.³

1909. *Aeshna haarupi* Calvert, Ann. Carn. Mus. Pittsb. 6, p. 232.⁴ Probably not this species.

Material studied.—ARGENTINA: Mendoza, May 11, 1908, 1 ♂ with green paper labels "11/5/1908 Mendoza Jensen Ris" and "Aeschna Haarupi Ris," both probably in Foerster's hand, Oct. 27, 1906, 1 ♀, "from Morton" with label "Aeschna haarupi Ris ♀" in Morton's hand, Ch[acras] de Coria, December 12, 1907 (but an inner green paper label in a hand unknown to me seems to read "I 12 1907"), 1 ♀ topotypic; all the preceding in Mus. Zool. Univ. Mich.; Tafi del Valle (province of Tucuman?), 10.xii.47, Golbach, 1 ♂, coll. F. C. Fraser. Total 2 ♂, 2 ♀.

A. C. Jensen-Haarup, collected at Pedregal and Chacras de Coria the material described by Ris.¹ Jorgensen gives the altitude and location of the former as 696 m., swamps 17 km. east of Mendoza, and of the latter 936 m., "9 miles more southerly (from Mendoza) both at the first range, Precordillera de Mendoza" (Proc. Acad. Nat. Sci. Phila. 1913, p. 274). Gannett states the altitude of Mendoza as 2376 feet = 724 m. (Monthly Bull. Internat. Bur. Amer. Repubs., U. S. Dept. Inter. Wash., 1904, p. 56).

Distribution.—Not known outside the provinces of Tucumán and Mendoza, Argentina.

Altitudinal Range as above.

♂. Area bordering the stem of the T-spot of the frons whitish, which is wider than the stem and is followed by a grey blue spot sharply distinct from the yellow on the side of the frons bordering the eye margin; sides of the stem converging strongly cephalad. Frons less angularly produced forward than in *cornigera*.

Thoracic stripes pass from whitish yellow ventrally to greenish blue dorsally; antehumerals converging upward and reaching almost to the antealar sinus, a small blue spot between its upper end and the sinus and one in the sinus; mesepimeral with a shallower ventral and a deeper dorsal emargination on its anterior margin; metepimeral with a circular emargination near the middle of its anterior margin.

Abdominal ground color blackish, pale spots blue or green, antero-dorsal AD very small on segment 2, present on 3-7, apparently interrupted mid-dorsally; medio-dorsal MD on 2-8, postero-dorsal PD on 3-10, not confluent with its fellow of the opposite side except on 10; post medio-dorsal PMD on 3-8, but faded or absent in the Tafi d. Valle ♂; antero-lateral AL on 3-8, medio-lateral ML on 3-8, apparently not confluent with other spots (Mendoza), or confluent with MD on 3-5 (T.d.V.); postero-lateral PL on 3-10, confluent with PD on 3 and 8-10 (Men.) or not confluent (T.d.V.); ventral surfaces of 9 behind the parameres and of 10 bluish or even bright blue.

Auricles of abdominal segment 2 of the Mendoza male bluish, margins black or dark brown, 3 teeth on the hind margin, the most lateral much shorter and less acute than the other two; in the Tafi del Valle male the third most lateral tooth is absent from both auricles, on the right auricle the other two teeth are normal, while on the left auricle the second tooth is split into two subequal slender teeth.

Spines of the anterior lamina reaching caudad as far as the level of the apex of the meso-posterior angle of the hamular process* and almost to the level of the hind end of the hamular lobe. The parallel mesal margins of the hamular processes not acute but almost rectangular anteriorly, posteriorly curving away from each other. Hamular lobes slightly shorter than the processes, truncated laterad and caudad posteriorly. The posterior hamules with pale hairs.

The anterior hamules, including the hamular processes and hamular lobes, and the posterior hamules are omitted from our figure 240, plate XVIII.

Superior appendages longer than abdominal segments 9 + 10, widened gradually from base to .36 of their length, thence of nearly uniform width (.74 mm.) almost to apex which is truncated obliquely caudad and laterad, ending in

* To determine the distinctness of the spines of the anterior lamina, on Sept. 8, 1951, I passed a fine diverging bristle in a fine camel's hair brush under the right spine of the Mendoza male (original of our fig. 240, pl. XVIII), from the middle line of the genital fossa so that I could see it on the lateral side of the spine. I did not succeed in doing this in the Tafi del Valle male, as the spines here were apparently pressed too closely on the adjoining parts to permit the bristle to go between them. There is nothing in *Ae. (H.) manni* even approaching such a spine under which a bristle could be thrust. The following day, I made a similar attempt with a male of *Ae. (H.) psilus* from Costa Rica, but the rudimentary spines of the anterior lamina are much too short and too closely applied to adjacent parts to pass the fine bristle under them.

an acute point at the outer (lateral) margin; margins entire, more than the middle third of the inner margin almost straight and almost parallel to the outer margin; the superior almost median longitudinal carina beginning at .53 of the appendage length, almost straight until near the truncation of the apex where it curves laterad into the acute point; in profile view the apex bent ventrad, acute, hardly hooked. Viewed in profile, each superior appendage is a little concave superiorly in the basal half, whence the superior carina is markedly convex and curves downward at the apex into the terminal point which projects slightly below the mostly convex inferior margin; no inferior basal projection.

Inferior appendage reaching to .46-.43 of the length of the superiors, triangular in dorsal or ventral view, its apex .17-.13 as wide as its base, rounded, with two upturned almost straight denticles at tip.

Wings clear (Tafi d. Valle) or faintly yellow at base barely to the first antenodal (Mendoza), costa yellow to stigma, other veins mostly brown, stigma brown ochre (Mendoza) or pale brown (T. d. Valle) surmounting less than 2-3 cells, membranule white, distal half dull black.

♀. Differs from the male as follows: Anterior surface of the frons in the Mendoza ♀ as described for the Tafi d. Valle ♂; face pale yellow in the Chacras de Coria ♀ which has the sides of the stem of the T-spot concave, the stem bordered by wider yellow in both females. Epimeral stripes wider (Table 3). Black or dark brown areas on the abdomen narrower; antero-dorsal AD and antero-lateral AL pale spots confluent on segments 3 and 4, medio-dorsal MD on 8 a small dot (Mendoza) or a small transverse streak (Chacras d. Coria), post medio-dorsal PMD somewhat obscured, reddish brown on 3-7, confluent with postero-dorsal PD on 8 and 9, medio lateral ML confluent with postero-lateral PL on 3-8 (Mendoza), not confluent (Chacras d. Coria). Anal appendages shorter than abdom. segments 9 + 10, maximum width .57-.65 mm., at mid length, straight, margins symmetrical, apex acute and central (Mend.), or inner margin more convex than outer (Ch. d. C.). Genital valves reaching caudad to slightly beyond segment 9. Wings faintly yellow at base almost to the second antenodal.

Dimensions.—Abdomen (excluding appendages) ♂ 36-38 mm., ♀ 35-41, sup. apps. ♂ 4.74-4.91, ♀ 2.86-3.11, hind wing ♂ 38, ♀ 38-39, stigma of front wing, costal margin ♂ 2.45-2.62, ♀ 3.11-3.27 mm. Front wings with 13-15 antenodals, 9-11 postnodals, hind wings with 8-11 ante- and 11-12 post-nodals.

The much more extensive material of this species originally described by Ris¹ showed a wider range of yellow coloring on the wings than in the present lot.

The females of *haarupi* and of *cornigera planaltica* are much alike and are sympatric. They differ in that *haarupi* females have the pale area on each side of the dark stem of the T-spot of the frons wider than the stem and the anal appendages usually much shorter, 2.85-3.5

mm., while *c. plaualtica* females have the pale area narrower than the dark stem of the T-spot and the anal appendages usually much longer, 3.52-6.80 mm.

Aeshna (Hesperaeschna) williamsoniana

Tables 1, 3, 4, 6, 9, 12, 14; Pls. XXXVIII, figs. 513, 514, XXXIX, XLVI, figs. 604, 605; Map 2.

1905. *Aeshna williamsoniana* Calvert, Biol. Centr.-Amer. Neur., pp.180, 185, tab. VIII, figs. 13, 14 (apps. ♂), 19 (top of frons ♂).¹

1909. *Aeschna williamsoniana* Martin, Coll. Zool. Selys-Longchamps Cat. Syst. Descr. fasc. XVIII, p. 57, fig. 53 (apps. ♂), pp. 81, 84.²

Material studied.—MEXICO: Cuernavaca, Morelos, July 8, C. C. Deam, 1 ♂ holotype. PANAMA: Chiriqui Mts., Boquete, 5000 feet, March 28, 1923, F. M. Gaige, 1 ♀, no. 304, "*Aeshna williamsoniana* Calv. det L. K. G[loyd] 1937". Both ♂ and ♀ in Mus. Zool. Univ. Mich. Total 1 ♂, 1 ♀.

Distribution.—Mexico,^{1 2} Panama.²

Altitudinal Range.—Both localities cited above are at 1525 meters = 5000 feet elevation.

♂. Face: anterior surface of frons and rhinarium dark brown, of nasus blue; frons with no dark T-spot above but with a small indistinct green spot on each side of the dorsal surface, carina separating the anterior from the dorsal surface, viewed from above, shows a marked median anterior curve.*

Pterothorax blackish brown; a green antehumeral stripe nearly 2 mm. wide at its upper end, narrowing and diverging anteriorly from its fellow of the opposite side, hardly reaching the anterior mesothoracic border but confluent with the green of the antealar sinus; epimeral stripes and a small superior metepisternal spot between them green.

The following abdominal markings green: PD confluent on segment 1, on 2 AD confluent, ML enveloping the auricle, PD confluent with PL; MD on 3-8; PD confluent with PL on 3-8.

Auricles of 2, each with 2 teeth.† Spines of the anterior lamina reaching caudad almost to the level of the hind end of the hamular processes, which are acute anteriorly; sides of the cleft of the lamina not diverging caudad but parallel and almost attingent. The sheath of the penis extends caudad to the level of the genital lobe.

* The description of the frons given above is from my original description of 1905; Miss Eager's drawing from the holotype (our fig. 515, pl. XXXIX), however, shows a distinct T-spot.

† So my original description of 1905; Miss Eager's drawing from the holotype (our fig. 521, pl. XXXIX) shows 3 teeth.

Superior appendages shorter than abd. segs. 9 + 10, straight, in dorsal view outer margin slightly sinuous, inner margin concave in proximal fifth, thence strongly convex so as to widen the appendage to about 1.09 mm. at 2/3 length, thence narrowing to an acute point on the outer margin, directed outward; margins entire; a superior mid-longitudinal carina, subparallel to the inner margin. In profile view upper margin concave, angulated at slightly more than 1/3 length where the outer margin appears to form the remaining 2/3 of the upper margin; lower margin also angulated near the same level, so that the upper and lower margins converge for the basal third and are subparallel for the remaining 2/3, the extreme apex curved downward as an acute point.

Inferior appendage reaching barely beyond mid-length of the superiors, triangular in dorsal view, apex .22 as wide as base, truncated, with two upturned denticles; in profile view concave above, convex below, decreasing in thickness from base to apex.

Wings somewhat smoky toward the apex and along the posterior margin, venation generally blackish, costa with a brownish line, stigma pale brown, membranule greyish brown.

♀. Differs from the male as follows: Anterior surface of the nasus brown ochre, pale color of the top of the frons showing only a weak contrast with the dark stem of the T-spot, labrum pale reddish brown, paler than the nasus; the green antehumeral stripe 1.31 mm. wide at its upper end, not confluent with the green of the antealar sinus; first tibia slightly reddish superiorly; ML on abd. seg. 2 not reaching ventrad apparently as far as the site of the auricle of the male; pale green AL spots on segs. 3-7, a small ML spot on 5-8.

Dorsal surface of abd. seg. 10 with no dorsal tooth, ventral surface armed with about 50 black spinules up to .19 mm. long, arranged in 4-5 transverse rows, those of the hindmost row longest, spinulated area 1.64 mm. wide, subequal in width to the combined width of the genital valves. Gonapophyses reaching to, but not beyond the produced part of seg. 10, their ventral margins not serrate, hind margin of basal plate almost straight, transverse; ovipositor reddish brown, pale straw color at apex visible beyond the genital valves; genital valves indian red at base, becoming blackish at apex, their palps lost; lateral genital plates 1.8 mm. long, reaching to mid-length of the tergum of 9, brown ochre, paler at mid-length, black in apical fourth. Pterostigma brown ochre, membranule pale brown.

Dimensions.—Total length ♂ 57 mm. Abdomen (excl. apps.) ♂ 50, ♀ 46.5, sup. apps. ♂ 5, ♀ 1.13; * hind wing ♂ 52, ♀ 54, stigma, front wing, costal margin ♂ 4, ♀ 4.17. Front wings with 16 and 17 antenodals ♂, 19 and 20 ♀, 11 postnodals ♂, 12 and 14 ♀, hind wings with 12 antenodals ♂, 13 and 14 ♀, 12 and 13 postnodals ♂, 15 and 16 ♀.

* From Miss Eager's drawings, our figs. 524, 525, pl. XXXIX.

Aeshna (Hesperaeschna) confusa

Tables 1, 3, 4, 6, 10, 12, 14; Pl. VIII; Map 3.

1842. *Aeschna confusa* Rambur, Hist. Nat. Ins. Nevr. p. 205.¹
 1861. Hagen, Syn. *Aeschna confusa* Neur. N. Amer. p. 314.²
 1875. *Aeschna confusa* Hagen, Proc. Boston Soc. Nat. Hist. 18: p. 39.³ (in part, excluding the Curico, Chile specimens which are *Ae. Neureclipsa elsia*, see postea).
 1896. *Aeschna confusa* Martin, Boll. Mus. Zool. Anat. Comp. Torino 11 (239), p. 3.⁴
 1904. *Aeschna confusa* Ris, Hamburg. Magal. Samm. Bd. II, Odon. p. 25.⁵
 1908. *Aeschna confusa* Ris, Deutsch. Ent. Zeit. pp. 523, 525, figs. 5a, b (color pattern head & thor., apps. ♂).⁶
 1908. *Aeschna confusa* Martin, Coll. Zool. Selys-Longch. Cat. Syst. Descr., fasc. XVIII, p. 52, fig. 49 (apps. ♂), p. 84; 1909. fasc. XX, p. 213.⁷
 1913. *Aeschna confusa* Ris, Mem. Soc. Ent. Belg. 22, p. 85.⁸
 1916. *Aeshna confus* Navas, Broteria, Zool. 14 (1), p. 17.⁹
 1920. *Aeshna confusa* Navas, Rev. Mus. Paul. 12, p. 4.¹⁰
 1927. *Aeshna confusa* Navas, Estudios, Buenos Aires p. 23.¹¹
 1928. *Aeschna confusa* Gazulla & Ruiz, Rev. Chil. Hist. Nat. 32, p. 290.¹²
 1929. *Aeshna confusa* Navas, Rev. Soc. Ent. Argent. 10, p. 220.¹³
 1931. *Aeschna confusa* Scott, Ent. Mo. Mag. 67, p. 279.¹⁴
 1933. *Aeshna confusa* Navas, Rev. Acad. Cien. Madrid 29, p. 54.¹⁵
 1947. *Aeschna confusa* Fraser, Acta Zool. Lilloana 4: 448.¹⁶

Material studied.—BRAZIL: Nova Teutonia, Santa Catharina, 27° S., 52-53° W., 1 Dec., 1936, Fritz Plaumann, 4 ♂, 3 ♀, coll. Kennedy, 3 ♂, 1 ♀, coll. Cowley; Rio Grande do Sul, H. Smith, 2 ♂, 1 ♀, MCZ. URUGUAY: Aigua, 26 Dec., 1935, H. Schneider, 1 ♂, coll. Cowley; Montevideo, Ac 21,699 and 21,999 U[nited] S[tates] F[ish] C[ommission], USNM 2 ♂, 2 ♀, Montevideo Harbour 1923, R. H. Nicholson, 1 ♂ labeled "*Aeshna confusa* Ramb. det. D. E. Kimmins" "Brit. Mus. commut. 12-7-38," coll. E. Schmidt; no definite locality 1 ♀, USNM. ARGENTINA: Tigre, Bs. Aires, Jan. 1936, K. J. Hayward, 1 ♂, 1 ♀, coll. Cowley; Buenos Aires, 15.xii.1946, 1 ♀ (head lost, apps. broken), coll. Fraser. CHILE: Talca 3 ♂, 1 ♀, Concepcion 1 ♂, 1 ♀, Penco 10 ♂, all I '05, Carlos Reed, ANSP; Purén, Prov. Malleco, 6 Jan. 1942, 1 ♀, Miguel Cerda, Angol, 16 Feb. 1941, 1 ♂, 4 Jan. 1941, 1 ♂, and Nueva Imperial, 6 Jan. 1942, 1 ♀ by D. S. Bullock, coll. Needham; no definite locality "Staudinger Vd." 1 ♂, 1771, "*Ae. confusa* det Cowley," coll. Cowley; total 31 ♂, 13 ♀.

Distribution.—Theophilo Ottoni¹⁰ in Minas Geraes, Brazil,^{3 7 9 15} to Montevideo,^{3 5 6} Uruguay, and Buenos Aires^{1-6 8} and Sierra de Cordoba¹¹ in Argentina,^{7 13} Talca to Nueva Imperial in Chile.

Descriptions of eastern Brazil are given by Bigarella (1946 Arq. Biol. e Tecnol. 1: 75-111), Dansereau (1950 Sci. Monthly 71-2-: 71-84), Holt (1928 Bull. Amer. Mus. Nat. Hist. lxxvii: 251-326), Maack

1948 Arq. Biol. e Tecnol. 3: 99-200), Moulton (1945 Journ. Geogr., Menasha, Wis. 44 (9): 367-370), Schmidt & Inger (1951 Fieldiana, Chicago, Zool. 31 (42): 439-465), Plaumann (1940 Revist Entom. 11 (3): 908-920), Smith, L. B. (1945 Plants and Plant Science in Latin America, Chronica Botanica Co., Waltham, Mass.), Veloso (1948 Mem. Inst. Oswaldo Cruz 46 (1): 89-124) and Waibel (1948 Geogr. Review, N. York xxxviii (4): 529-554). The only author of those here quoted who groups organisms into biogeographical regions is Holt who, in the Serra do Itatiaia, State of Rio de Janeiro, recognizes a foothill region 1400-2000 feet, 426-610 meters, a forest region 2000-6000 ft., 610-1829 m., and a campo region above 6000 ft., 1829 m.; a tropical zone embracing all the foothill region and up to 3000 ft., 914 m., a subtropical zone of tall trees, including most of the forest region, a temperate zone of ridges, broad slopes and rocky peaks above 6000 ft., 1829 m., and is exactly coextensive with the campo region; it is chiefly treeless grass land but there are many copses of dwarf forest and some wide bands of woods which are really continuous extensions upward of the Forest Region; it is "a region of heavy rainfall, considerable fog and low temperature." Pinto (1951), in dealing with the same area employs three zones which conform to those of Holt.

The avifauna of Brazil has been treated in recent years by Griscom & Greenway (1941 Bull. Mus. Comp. Zool. 88 (3): 83-344), Gyldenstolpe (1945 K. Svenska Vetenskapsakad. Handl. 22 (3): 1-338) and Pinto (1951 Papeis Avulsos Dept. Zool. S. Paulo 10 (9): 155-208).

The fresh-water fishes of Brazil are discussed by Fowler (1954 Arq. Zool. S. Paulo 9: 1-400), who quotes Eigenmann, 1903, that the Characin fishes "have inhabited South America since the early Tertiary at a time when the tropical part of the continent probably consisted of two islands, one occupying the Guianas and the other the plateau of Eastern Brazil."

I have not seen Ribeiro's Esboco Geral der Fauna Brazielera, Rio de Janeiro, Minist. Agricult., 8vo., 1922: 1-45, many plates and figs., nor Serebrenick's Notas sobre o clima do Brasil, Ministerio da Agricultura, Servicio de Documentação, Rio de Janeiro, 1945.

Altitudinal Range.—Sea-level to 100 m. (328 ft.) in Chile, to 500 m. (1640 ft.) in Brazil.

Seasonal Range.—November to February.

♂. Face pale blue, upper part of anterior surface of frons somewhat reddish brown, pale area bordering the black stem of the T-spot yellow, narrower throughout than the stem, this bordering yellow followed laterad by obscure

bluish or purplish which extends laterad beyond the level of the tip of the top of the T; in some males the base of each hair in the bluish or purplish is surrounded by a pale circular spot, thus giving a speckled appearance. The pale bluish of the labrum shading into cream or pale brown inferiorly; a fine transverse basal, black line in some. Occiput yellow, narrowly margined with black, at least laterally, its hind margin straight. Rear of eyes blackish brown.

Pterothorax near brown pink of Smith's Glossary, pl. IV, fig. 21, with numerous pale hairs and greenish yellow stripes as follows: antehumeral 2.94-3.11 mm. long, nearly as long as the mesepisternum, widening anteriorly from .16-.24 mm. at the upper end to .41-.5 mm. at the lower end, barely divergent from its fellow of the opposite side; mes- and met-epimeral stripes reaching upward to the upper margin of their sclerites, nearly straight.

Abdomen pale reddish brown, marked with blue as follows: a transverse antemedian band MD immediately behind the transverse accessory carina on segments 3-7 or 8, divided by the mid-dorsal carina into two triangular spots, one on each side, postero-dorsal spots PD on 3-10 separated by the black mid-dorsal carina, more widely so on 8 and 9, no antero-dorsal spots AD on 3-10; (PMD reddish brown on 3-9, not confluent with other pale spots; antero-lateral spot AL on 2-8, largest on 3, decreasing caudad; a medio-lateral spot ML immediately behind the transverse accessory carina on 2-8; a postero-lateral spot PL on 3-9, confluent with PD on 3-9 or only on 6-9; a ventral stripe on each side of 4-7, nearly as long as the segments, a pair of ventral basal spots on 8, interned ventral edges of terga of 9 yellow, sterna of 9 behind the parameres and of 10 blue, often faded.

Auricles of 2 each with 2 teeth. Cleft of the anterior lamina diverging from the anterior end of the genital fossa caudad to a width of .38-.5 mm., area between the cleft pale yellowish between blackish margins or blackish, even in the same locality (Nova Teutonia); spines of the lamina curved slightly mesad, reaching caudad to a variable distance with respect to the level of the hind end of the hamular fold, i.e., not as far as, almost as far as, or to behind, that level; since these variations are all found in individuals from Nova Teutonia they may be due to operations on them attempting preservation of color. Anterior end of the hamular process acute. Posterior hamules at junction of fore and mid lobes of the genital fossa curved forward; acute anterior end of the sheath of the penis slightly in front of that level; rounded hind end of the sheath variable in respect to the lobes of the fossa in Nova Teutonia males, perhaps for the same cause as suggested above.

Superior appendages subequal in length of abd. segs. 9+10, similar to those of *Ae. (H.) californica* but the inner margin of the distal half more concave, the superior carina submedian, the inferior projection in profile view rounded both anteriorly and posteriorly (Montevideo); in a Penco male the appendages are narrower at the level of the apex of the inferior appendage, there is no concavity on the inner margin and the distal end of the superior carina shows a steeper descent in profile view. Inferior appendage half as

long as the superiors, more slender than in *californica*, apex .17-.21 as wide as base.

Wings hyaline, first three longitudinal veins yellowish, remainder of venation darker brown. Pterostigma surmounting more than two cells, indian red above, ends, or only the distal end, pale, approaching gamboge below. Membranule cinereous, only the extreme base paler.

♀. Differs from the male as follows (based on Chilean females): Face tending to rosaceous (teneral) or pale clay yellow, no brown or dark line on the fronto-nasal suture, T-spot pale brown to pale vandyke brown, in some females the stem a little wider at mid-length. Labrum obscurely colored. Hind edge of occiput slightly concave or straight. Rear of eyes paler brown in some. Tibiae pale brown or yellowish superiorly.

Abdominal colors faded, pale yellowish or pale brown, black lines on most of the carinae; pale spots on 3-10, including PMD, indistinct, barely evident as paler brown, a short transverse blackish line on each side of 3-7 or 8, between the accessory and apical transverse carinae, followed by a black dot in some females, no blue on the sterna.

Ovipositor reddish brown, visible for entire length of genital valves; genital valves luteous, reaching to the level of the hind margin of the tergum of 9, their palps reddish brown, reaching to about one-half of the mid-length of 10, with an apical pencil of dull yellowish hairs; basal genital plate with posterior margin straight; lateral genital plates straight, yellowish, visible for nearly entire length and reaching to nearly mid-length of lateral margin of tergum of 9. Width of ventral spinulated area of 10 nearly equal to the total width of the genital valves. Anal appendages subequal to segments 9 + 10, straight, outer margin barely convex to barely concave, inner margin convex throughout, apex rounded, a low, superior, submedian, longitudinal carina.

A brownish yellow cloud on the wings of the Tigre female from a little beyond the nodus to the level of the distal end of the stigma, but not extending behind M4spl, and a slight yellowish tinge at the extreme base of the hind wings.

Dimensions.—Abdomen (excl. apps.) ♂ 33.5-37, ♀ 34.5-37; sup. apps. ♂ 3.76-4.34, ♀ 3.76-4.66; hind wing length ♂ 34.5-38, ♀ 35-40, maximum width ♂ 11-13, ♀ 13.5-14; stigma, front wing, costal edge ♂ 2.54-3.19, ♀ 3.27-3.68 mm. Front wings 12-15 antenodals, 8-11 postnodals, hind wings 8-10 antenodals, 9-12 postnodals.

Ecology.—*Confusa* has been recorded twice as appearing on ships off the mouth of the Rio de la Plata. Ris,⁵ page 29, observed it around New Year's of 1890-91 in many hundreds on board the steamship Darmstadt, many miles from (almost out of sight of) land; a tolerably violent thunderstorm had carried them out; they were not yet fully colored; equally abundant with them was *Ae. (Neureclipta) bonariensis*. Scott¹⁵ states that three males two females of *confusa*

came on board H. M. Ship Eagle, on February 23, 1931, when about 60 miles from land off the Rio Plata.

Discussion.—Rambur's type and apparently only specimen was a female; the female from Rio Grande do Sul in the MCZ agrees well with his description and his comparison.

More abundant material, 28 ♂, 12 ♀, of *confusa* than was enumerated in our Table 14, was tabulated for the number of vertical rows of cells in the anal loop of the hind wings and for the number of rows of cells between the fork of Rs at the level of the distal end of the stigma in both front and hind wings, with these results: 3 vertical rows in the anal loop 97½ per cent, 2 vertical rows 2½ per cent; 3 rows between the fork 85% front wings, 90% hind, only 2 rows 12½% front, 6¼% hind, 4 rows 2½% front, 3¾% hind; these variations are not characteristic of the localities where they occur. *Ae. confusa* with 4 rows between the fork approaches *variegata* and *punctata* in this respect, but differs from them in the long pale antehumeral stripe versus the short stripe of those two species. The anal triangle of the hind wing of *confusa* male is normally 3-celled, but in the right hind wing of one male from Nova Teutonia is 4-celled, due to the vein, which normally divides the two basal cells from each other, having become attached at its mid-length to the mesal side of the triangle, thus forming two triangular cells in place of the usual, mesal, quadrangular cell; the other basal, lateral, cell has thereby become pentagonal.

Ae. (H.) cornigera Tables 1, 3, 4, 6, 10, 12, 14; Pls. IX, X; Map 2.
1865. *Aeschna cornigera* Brauer, Verh. zool.-bot. Ges. Wien 15: 906.¹
1866. *Aeschna cornigera* Brauer, Reise der Novara Neur.; 70, t.1, fig. 16 (apps. ♂).²

Two subspecies of *cornigera* may be recognized as follows:

Pale lateral thoracic (mes- and met-epimeral) stripes not constricted on their anterior margins *cornigera cornigera*
Pale lateral thoracic (mes- and met-epimeral) stripes constricted on their anterior margins by a deep sinus or indentation *cornigera planaltica*

Correlations have been sought between the (a) non-constricted, (b) shallowly constricted and (c) constricted mes- and met-epimeral green stripes on the one hand by tabulating 11 males of (a), 10 males of (b) and 16 males of (c) for the presence of the following features on the other hand:

- (d) a distinct shining conical tubercle on each adanal plate (half sternum of abdominal segment 11) (see page 18 *antea*) ;
- (e) length of the elevated, anteapical, superior carina of the superior abdominal appendages, as seen in profile view, measured to the appendage tip ;
- (f) maximum height of the same carina, profile view ;
- (g) apex of the superior appendages, in profile view, as to whether it is not hooked or barely hooked ;
- (h) stoutness of the mid-dorsal spine on abdominal segment 10, in profile view, as measured by the antero-posterior diameter of its base ;
- (i) narrow line on the fronto-clypeal (fronto-nasal) suture as black, dark brown or brown ;
- (j) width of the stem of the black T-spot on the superior surface of the frons at its base (posterior end) ;
- (k) maximum width of the frons, usually measured from above in dorsal view ;
- (l) width of pale area of membranule of hind wing, measured at right angles to vein A ;
- (m) length of hind wing ;
- (n) length of abdomen, excluding appendages.

For m and n 8 additional males of a, 2 additional males of b and 2 additional males of c are included.

Errors which attend the making of exactly comparable measurements for each individual studied exist in the difficulty of placing them in exactly the same position in the cases of e, f and g, in the selection of the exact base in h and in deciding on the boundary between the pale and dark areas in l.

Bearing in mind these undoubted sources of error, it may be stated that the ranges of variation in millimeters and decimals of millimeters which have been obtained are sufficiently close for a, b and c as *not* to indicate any correlation between any of these three with any of the features e, f, h, j, k and l. The highest percentages of color on the fronto-clypeal suture i are a brown 80, b brown 70, c dark brown 44. The nearest approaches to correlated characters are for a, apex of the superior appendages not hooked 86%, hind wing 38-43 mm. (41 most frequent), abdomen 38.5-45 (42 most frequent) ; for b, apex not hooked 80%, hind wing 38-42 mm (39, 40 and 41 equally frequent), abdomen

40-45 mm. (41 most frequent) for c, apex barely hooked at extreme tip 75%, hind wing 37-40 mm. (40 most frequent), abdomen 38-41 (40 most frequent).

The individuals with non-constricted epimeral green stripes (a) and those with these stripes shallowly constricted (b) appear to be more nearly alike than (b) is to (c) with these stripes deeply constricted; moreover b individuals are from localities where a rather than c individuals occur. I therefore tend to recognize only two subspecies, a and c respectively.

On comparing 6 ♂, 1 ♀ (2 ♂ Colombia, 4 ♂, 1 ♀ Ecuador of *cornigera cornigera* with 4 ♂, 2 ♀ (1 ♂ Ecuador, 3 ♂, 2 ♀ Brazil) of *cornigera planaltica*, in all of which the epimeral stripes and the markings of the second abdominal segment are distinct, and with fig. 131, pl. X of *c. planaltica* from Nova Teutonia, Brazil, I find no differences in the markings of the second abdominal segment to distinguish these two subspecies. In *both* lots the following variations in those markings exist: the length of the anterior arm of AL as shown in the height on the segment to which it extends, the height of the point of separation of the anterior and posterior arms of AL, the breaking (as shown in pl. XXXI, fig. 416 for *psilus*) or not breaking of the posterior arm of AL into two pieces, one dorsal to the other; the separation or confluence of PD and PL; the extent cephalad from the hind margin of segment 2 toward the transverse median carina to which PL reaches; the presence or absence of AV and MV. The markings of the second abdominal segment of *psilus* and *haarupi* are very similar to those of *cornigera*; they are figured on pl. XXXI (fig. 416 and pl. XVIII, fig. 237 respectively). The number of individuals accessible to me with colors of segment 2 well preserved is too small to enable me to determine whether the differences these figures show from each other and from *cornigera* have any specific significance.

The earlier remarks of Dr. Ris (1918) and of myself (1905) concerning variations within *cornigera* can not be applied without modification to the present conclusions on this species, since my interpretations of *cornigera* included what I now recognize as distinct species, e.g., *mauni* and *psilus*, *psilus* being also included in *cornigera* by Dr. Ris, all of which has been set forth in my paper of 1947.²⁶ See postea page 44.

- Ae. (H.) cornigera cornigera** Tables 1, 3, 4, 5, 6, 10, 12, 14; pl. IX; Map 2.
 1952. *Aeshna* (*Hesperaeschna*) *c. cornigera* Calvert, Ent. News lxiii: 255.³
 1867. *Aeschna cornigera* Hagen, Verh. zool.-bot. Gesl. Wien xvii: 49 (in part, Colombia, Venezuela).⁴
 1875. *Aeschna cornigera* Hagen, Proc. Boston Soc. Nat. Hist. xviii: 39 (in part, Col., Ven.).⁵
 1899. *Aeschna cornigera* Calvert, Proc. Calif. Acad. Sci. (3) Zool. 1 (12): 408 (Brauer's type at Vienna).⁶
 1907. *Aeshna cornigera* Calvert, Biol. Centr.-Amer. Neur.: 400 (in part, Mex., Col.).⁷
 1908. *Aeschna cornigera* Martin, Colls. Zool. Selys-Longchamps, Cat. Syst. Descr. fasc. xviii: 46⁸ (in part only, not fig. 42; cf. Williamsons, Occas. Papers Mus. Zool. Univ. Mich. 216: 34; see postea).⁹
 1918. *Aeschna cornigera* Ris, Arch. Naturgesch. 82 (A) 9: 157 (in part, excl. countries south of Colombia).¹⁰
 1919. *Aeshna cornigera* Calvert, Ent. News xxx: 37. (Guatemala).¹¹
 1922. *Aeshna cornigera* Campos, Revista Col. Nac. Vicente Rocafuerte 1922 8-9: 33 (Ecuador).¹²
 1923. *Aeschna cornigera* Navas, Bol. Soc. Colomb. Cien. Nat. xii: 73 (Colomb.).¹³
 1938 (1939?). *Aeschna cornigera* Maria, Rev. Chilena Hist. Nat. 42: 206.¹⁴
 1953. *Aeshna cornigera cornigera* Ráçenis, Anales Univ. Centr. Venez. 35: 37.¹⁵

Material studied.—GUATEMALA: ¹⁰ Purulha, July 10, forest, 1 ♂; Volcan Santa Maria (Quezaltenango), 5500 ft. Nov. 1, 1 ♂; Chejel, Baja Vera Paz, 3100 ft., June 26, 1 ♂; Antigua, 5500 ft., Nov. 24, 1 ♂, 1 ♀; W. Schaus & J. T. Barnes, ANSP. COSTA RICA: Sanatorio above Tierra Blanca, Irazu, 7500 ft., 1921, A. G. M. Gillott, gift of C. H. Lankester, 2 ♀, ANSP. PANAMA: El Volcan Chiriqui, 17.II-4.III, 1936, 7 ♂, W. J. Gertsch, F. E. Lutz, AMNH. COLOMBIA: Santa Marta Mountains in Magdalena, San Lorenzo Mt., Hacienda Cincinnati and trails thereto, 4500-6000 ft., July 16-29, 1920, Rehn & Hebard, 3 ♂, 1 ♀, Vista Nieve, Dec. 22, 1922, H. L. Viereck, 1 ♀, Hacienda Cincinnati, 4000-5000 ft., M. A. Carriker, Jr., 1 ♀, ANSP; Hacienda Cincinnati, 4500 ft., clearing about a house, July 31, 1920, F. M. Gaige, 2 ♀, Santa Marta Mts., Dec. 27-31, 1916, J. H. and E. B. Williamson, 3 ♂, 4 ♀, Rio Negro, Boyaca, April 10, 1917, 2 ♀, UM; no definite locality, Felipe Ovalle, 3 ♂, AMNH. VENEZUELA: Merida, not dated, Higgins, 4 ♂, 2 ♀, UM; no other locality, 2 ♀, MCZ.^{4 5} ECUADOR: Rio Topo, Rio Napo, 12.III.'36, 1 ♂, Rio Bombaini-yacu, 900 m., on watershed between Rio Napo and Rio Pastaza, 22. III. 41, 1 ♂; Chin-chin, Rio Pastaza watershed, 1400 m., May, 1936, 1 ♀; Rio Pastaza at Baños, ca. 1750 m., 17.X.38, F. M. Brown, 1 ♀, Rio Verde, 1400 m., 27.8.38, F. M. Brown, 3 ♂; La Palmera, 1300 m., 12.XII.38 R, 3 ♂; Baños, Jan., '39, F. M. Brown, 1 ♂ AMNH, Feb. 20.'36, 1 ♂, 1800 m., July 18, '38, 1 ♂, Sept. '38, 1 ♀; Abitagua, 1000, 1100, 1200 m., 14 & 15.IV.'40, 2-8.VI.'39 &

'41, 13.IX.'39, 10 & 13.X.'39, 5 & 6.XI.'36 & '39, 11 ♂, 2 ♀; trail between Rios Fox and Guillermina, 1100 m., 6.III.'41, 2 ♂; Hacienda Guillermina, Rio Pastaza, 1200 m., 7.XII.'39, 1 ♀; Rio Blanco, 1700 m., 5.X.'39, 1 ♀; La Esperanza Rio Blanco, 2000 m., VIII.'36, 1 ♀; on Rio Pastaza, Yungilla to Abitagua, Nov. 1, '39, 1 ♀; Rio Pastaza watershed, Apr. 4 and May?, '36, 3 ♂; Agoyan, same watershed, May 22, '36, 1 ♀; Balzapamba, 700 m., 7, 9, 20 May, '38, 3 ♂; all preceding data from Ecuador, except three, by William Clarke MacIntyre in coll. Kennedy, 1 ♂ AMNH; Pallatanga, F. Campos R., 1 ♂, 1 ♀; Huigra or Duran, Feb. 12, 13, 1911, Samuel N. Rhoads, 1 ♂, 1 ♀; Naranjapata, 650 m., F. Campos R. 1 ♂, 1 ♀; preceding three localities ANSP; Morro Morro, Province El Oro, 1500 m., 22.VI.'41, 1 ♂, and Malacatus, 15 mi[les] S. and 3 mi E. of Loja, Province Loja, 1500 m., 14.VIII.'41, 1 ♂, by David B. Laddy in coll. Kennedy. PERU: vicinity of Rio Balsas, Marañon, Dept. Cajamarca, Andes, 1179 m., June 25, 1936, 1 ♀, Hermosa, 1600 m., 1-5 May, 1 ♂, Felix Woytkowski; La Merced, P. C. Biol. Serv. Rivas coll., 1 ♀ Coll. Kennedy; Oxapampa, "Staudinger Vd.," 2 ♂, "det. Cowley," coll. Cowley; Huacapistana, June 2, 1920, J. H. Williamson, 1 ♂, UM; Vilcanota, "cornigera Brau. via Staudinger 1928, det. Kruger", 1 ♂, coll. E. Schmidt. BOLIVIA: Songo, "Staudinger Vd. det. Cowley" 1 ♂, coll. Cowley. Total 66 ♂, 32 ♀.

Remarks on the preceding data.—The envelope containing one male is marked "Huigra or Duran"; as the altitude of Duran is but 5 meters, according to Prof. Campos¹² p. 9, while that of Huigra is more than 500 meters (Nat. Geog. Soc. map of S. America, 1942), in view of the distribution of this subspecies elsewhere in Ecuador it is probable that Huigra is the true locality for this male. Songo, Bolivia is not in the indexes of eight maps or atlases which I have been able to consult; the only information concerning it which I possess is "Rio Songo, Bolivia, 750 m., Marz, 1913." Fassl, Deut. Ent. Ztschr. Iris 29: 187, 189.

Distribution.—From 16° North Latitude in Guatemala to 17° or 18° South Latitude in Bolivia, in South America not east of 65° West Longitude. This area approximates the tropical and subtropical zones of Griscom 1932* in Guatemala, the Cordilleran zone of Carriker 1910† in Costa Rica, the subtropical zone of Griscom 1935‡ in Panama, the Paramo Zone of the Santa Marta region of Colombia of de Schauensee 1948§, equivalent in part to the subtropical zone of Chap-

* Griscom, L., 1932, Bull. Amer. Mus. Nat. Hist. LXIV: 29.

† Carriker, M. A., Jr., 1910, Ann. Carnegie Mus. VI: 318-326.

‡ Griscom, L., 1935, Bull. Mus. Comp. Zool. 78 (3): 272-289.

§ de Schauensee, R. M., 1948, Caldasia, Bogota, 5 (22): 263-265.

man 1917 * in Colombia, the tropical and subtropical faunal zones of Chapman 1926 as reprinted by Brown 1941 † in Ecuador—all these here listed based on birds; it falls within the North West, Central West, North Central, Central, South Central and North East provinces in Ecuador, Peru and Bolivia of Eigenmann & Allen 1942, ‡ based on fresh-water fishes. For Ecuador the tropical and subtropical zones of Chapman 1926 correspond to the Equatorial Hot, Tropical Hot and part of the Interandine Subtropical Natural Regions of Acosta Solis 1944. § For Peru I have not found a corresponding series of regions based on birds; I have therefore used the paper of Pulgar Vidal 1941 ¶ which comments on the fauna and flora. *Cornigera cornigera* occurs in the Yunga Fluvial, 1000-2500 m. of Pulgar Vidal. Chavez Chaparro 1950 ** has some criticisms of Pulgar Vidal. This area does not correspond with that of any one proposed zoo-geographical province.

Altitudinal Range.—The altitudes given above in the list of material studied are those furnished by the collectors, who may be supposed to know the elevations at which they obtained their specimens, rather than those to be found in lists published by geographers. The collectors' altitudes give the following ranges: in Guatemala 945-1676 m. (3100-5500 ft.); in Costa Rica to 2286 m. (7500 ft.); in Colombia 1219-1829 m. (4000-6000 ft.) in Ecuador 650-2000 m. (2132-6562 ft.); in Peru 1179-1600 m. (3868-5249 ft.). The ranges so obtained fall within the Tropical and Subtropical zones of Guatemala, Colombia and Ecuador, based by Griscom (1932 ††), de Schauensee (1948 ‡‡) and Chapman (1926 as reprinted by Brown 1941 †) on the avifauna of those three countries respectively.

* Chapman, F. M., 1917, Bull. Amer. Mus. Nat. Hist. XXXV: 84-93.

† Brown, F. M., 1941, Ann. Ent. Soc. Amer. 34 (4): 810.

‡ Eigenmann, C. H. & Allen, W. R., 1942, Fishes of Western South America, Univ. Lexington, Ky.: 40-41.

§ Solis, M. Acosta, 1944, Flora, Quito, Mayo de 1944: 139-208.

¶ Pulgar Vidal, J., 1941, Bol. Mus. Hist. Nat. Javier Prado 5 (2) 145-160.

** Chavez Chaparro, 1950, Revista Univ. Cuzco 39 (99): 239-241.

†† Griscom, L., 1932, Bull. Amer. Mus. Nat. Hist. LXIV.

‡‡ de Schauensee, R. M., 1948, Caldasia, Bogota, 5 (22): 263-265.

Seasonal Range.—Mr. M. A. Carriker furnished the following climatic data to the late E. B. Williamson in Feb., 1916, for the Santa Marta region of Colombia: Dry season December to March, maximum drought Feb. & March, Wet season rest of the year, bright but showery April to July, cloudy and misty September to November. According to Mr. Carriker's statement, and data by Hershkovitz (1947,* 1949*) *cornigera cornigera* flies in both seasons. Descriptions of southeastern Colombia are given by Allen (1947 †) and Bates (1948 ‡); of Ecuador north of Quito by an anonymous writer (1942 §) and Acosta Solís (1942 ¶); of the phytogeography of Peru by Williams (1945 **).

♂. Upper part of anterior surface of frons reddish brown or purplish, fronto-clypeal suture most frequently brown (76% of 21 individuals), sides of the stem of the T-spot convergent cephalad or subparallel, bordered by a pale yellow stripe which is narrower than the width of the stem and is followed laterad by green or bluish continuous or not continuous with the green or bluish of the frons; in strong light the boundary between the pale yellow stripe and the lateral green is much less marked. Labrum pale clay yellow, labium pale bluish at base, pale reddish distally. Occiput pale greenish or bluish, hind margin almost straight, a little convex at middle, lateral angles black, rear of eyes black.

Green antehumeral stripe reaching upward almost to the antealar sinus, wider than the brown separating it from the mid-dorsal carina, width at mid-height .74 mm. (Volcan Chiriqui)—1.96 mm. (Hac. Cincinnati), maximum width 1.23 mm. (Hac. Cincin.)—2.04 mm. (id.), diverging downward from its fellow of the opposite side, pointed at its lower end, a small pale spot immediately in front of the antealar sinus and one in the sinus.

Auricles of abdom. seg. 2 green or brown with two posterior teeth, in some a smaller third tooth laterad to the usual two. Anterior lamina cleft to base, in some sulcate, with a long slender spine each side whose apex extends caudad beyond the level of the most concave part of the hind margin of the hamular process or to beyond the level of the meso-posterior angle of that margin (fig.

* Hershkovitz, P., 1947, Proc. U. S. Nat. Mus. 97 (3208) : 1-46; 1949, op. cit. 98 : 323-427.

† Allen, P. H., 1947, Geogr. Rev. 37 (4) : 567-582.

‡ Bates, M., 1948, op. cit. 38 (5) : 555-574.

§ Anonymous, 1942, Anotaciones sobre la vegetacion del norte de Quito [with English summary], Quito Impr. Univer. 117 pp., 2 maps, 42 figs; not seen by the writer, only the abstract in Biol. Abstr. 17, #709.

¶ Solís, M. Acosta, 1942, Flora, Quito, 2 (34) : 71-112.

** Williams, L.I., 1945, Plants and Plant Science in Latin America, Chronica Botanica Co., Waltham, Mass., 308-312.

114, pl. IX, Colombia). Compared with this figure, the hind end of the hamular process in males from Pallatanga and Naranjapata, Ecuador, is narrower. The penis of no. 240 from Hacienda Cincinnati, after treatment with potash hydrate, was preserved and drawn in glycerine, the glans as fig. 116, pl. IX; on comparison with fig. 113 of the untreated glans of male no. 237 from the same locality, the following differences are noted: the apex of the treated penis, fig. 116, is more contracted in its distal sixth, expanded somewhat more at mid-length distad of the "wings", the "wings" appear more acute at the proximal end, the mid-longitudinal groove narrower. Fig. 113 was drawn under a compound microscope, 116 under a Zeiss binocular; owing to technical difficulties involved, the treated glans was viewed apico-ventrally, the untreated glans ventrally; the differences noted are perhaps due in part to the difference in the points of view. Some further comparisons will be found postea under *cornigera planaltica*. Genital lobe with about 20 spinules, up to .09 mm. long, in the dark-colored ventral margin.

Superior anal appendages as long as, or longer than, abd. segs 9 + 10 with no inferior subbasal tubercle; in dorsal view the inner (mesal) margin varying from slightly concave through almost straight to slightly convex and from not parallel to almost parallel with the outer margin, the apex bent a little laterad or mesad; in profile view the apex is, or is not, bent slightly ventrad and is therefore barely hooked or not hooked. Compared with figs. 102, 103, pl. IX, of a Colombian male, the males from Pallatanga and Naranjapata, Ecuador, have the appendages in dorsal view tapering more gradually to the apex; in the Pallatanga male the right appendage is abnormal in that the terminal spine is much longer and more slender than that of the left appendage, figs. 104-106, pl. IX, and the superior longitudinal carina, as compared with fig. 102 is lower and slopes more gradually to the apex; the maximum height of this carina above the lateral edge of the appendage as a base line is .28 mm. right, .52 mm. left, the distance from the proximal end of the carina to the tip of the appendage is 1.42 mm. right, 2.21 mm. left.

Inferior appendage $1/3$ to $2/5$ as long as the superiors, triangular in ventral or dorsal view, apex varying from .25 to .35 mm. in width.

Wings not colored, faintly yellow at extreme base only (Purulha), venation including costa reddish brown, stigma ochre brown, a little paler below, membranule greyish brown, narrowly whitish along vein A.

♀. Differs from the male as follows: Face and labrum pale brown; green antehumeral stripe in most cases not pointed at its lower end; genital valves reach to, or beyond, the level of the hind end of the tergum of abd. seg. 9; lateral plates of ovipositor reach to about half-length of the tergum of 9, but in two females (Abitagua and Baños, Ecuador) to the tips of the genital valves. Anal appendages shorter than, or equal to, the length of abd. segs. 8 + 9 + 10. Coloring of the wings variable, conditions which exist in the present material are: yellowish at base fading out before the triangles (Cincinnati, Colombia, no. 241, Venezuela, no definite locality, no. 188, Yunguilla Ecuador, Rio Balsas,

Peru, ♀ no. 246); wings more smoky yellow, especially bordering each antenodal and each cubital cross-vein (Cincinnati, Col., no. 245) or only those of the front wing (Santa Marta Mts., Col., no. 22); faintly yellow at extreme base and faintly smoky along entire length of hind margin of both front and hind wings (Chin-chin, Ecuador, no. 247); irregularly smoky on front wings between nodus and apex, less so on hind wings (Merida, Venez., no. 32); irregularly smoky between nodus and apex on front, but not on hind, wings (La Esperanza, Ecuador). Pterostigma cadmium yellow above, a little paler below (Cincinnati, Col., no. 241, Chin-chin, Ec., no. 247, Rio Balsas, Peru, ♀ no. 246).

Dimensions.—Total length ♂ 60-62 mm., ♀ 58-63, abdomen (excl. apps.) ♂ 40-45, ♀ 39-45; sup. apps. ♂ 4.74-5.97, ♀ 3.44-6.54; hind wing ♂ 38-43, ♀ 40-45; stigma, ♂ front wing, costal margin ♂ 2.13-2.62, ♀ 2.54-2.78. Front wings with 14-18 antenodals, 9-15 postnodals, hind wings with 9-12 antenodals, 10-16 postnodals.

Dr. William Schaus placed the following notes in the envelope of the Purulha male: "Frons and base of abdomen turquoise blue. Broad green lateral oblique stripes on thorax. Fine broken green transverse lines on abd."

Ecology.—The following notes by the collector, Mr. Felix Woytkowski are from the envelope containing the specimen in question. Rio Balsas ♀: "This species is rare, have seen 3-4 specs. Its green markings are of a brilliant, vivid green. Also the base of wings has a light brown flush. Seems a local race here as I met it exclusively half-way between Celedin and Balsas, in a shrub-covered region with pretty abundant irrigation canals, conducting water from the heights toward lower, cultivated spots. Took it flying; all other specimens were seen flying too over brush along the mentioned waters. Its abdomen is plump and thick". See notes postea on the male of *cornigera planaltica* from the same locality.

Discussion.—In 1935, when at the Museum of Zoology of the University of Michigan, at Ann Arbor, I was shown E. B. Williamson's copy of Martin's Aeschnines;⁸ alongside the figures of the appendages of the male *Aeschna cornigera*, page 46, was this note in his handwriting "figg. surely not cornigera EBW 5/20/24". He put this note into print in 1930:⁹ "It should be noted that fig. 42, page 46, Martin's Coll de Selys Aeschnines is not cornigera, as labeled, but is probably marchali. Other figures in this work are incorrectly labeled."

In the key to genera, subgenera, species and subspecies, antea pages 10, 11 the 3-celled condition of the anal triangle of the hind wing of the male and the maximum number of three rows of cells within the fork of Rs under the pterostigma of both front and hind wings of both sexes are used as characters distinguishing *Ae. cornigera* et al. from other species (e.g., *variegata*) which have four rows of cells in this fork. Attention has been paid to the amount of variation in these two characters with the result that out of 60 males, 23 females of *cornigera cornigera* three cells were found in the anal triangle of 59 males (98.33%) and four cells in both hind wings of one male (1.67%); a maximum of three rows of cells in the fork of Rs was found in 94.2% of front wings of males and 93.5% of females, in 85% of hind wings of males and 93.5% of females. The remaining 5.8% of male and 6.5% of female front wings and 15% of male and 6.5% of female hind wings had a maximum of four rows of cells in the fork of Rs under the stigma. The figures here given differ from those in our Table 14 in that here the sexes are tabulated separately, while in Table 14 the two sexes are tabulated together for the rows of cells in the fork.

In only one male (Purulha, Guat.) do all four wings have four rows of cells in this fork; two males (Abitagua, Ecuador, Huacapistana, Peru) each have four rows in three wings; two females (Santa Marta Mts., Col., Agoyan, Ec.) each have four rows in two wings; eight males, two females each have four rows in only one wing.

- Ae. (H.) cornigera planaltica** Tables 1, 3, 4, 6, 10, 12, 14; Pl. X; Map. 2.
 1952. *Aeshna (Hesperaeschna) cornigera planaltica* Calvert, Ent. News lxiii: 255 (Brazil, Ecuador).¹³
 1867. *Aeschna cornigera* Hagen, Verh. zool.-bot. Ges. Wien xvii: 49 (in part, Brazil, Uruguay).¹⁴
 1875. *Aeschna cornigera* Hagen, Proc. Boston Soc. Nat. Hist. xviii: 39 (in part, Brazil, Uruguay).¹⁵
 1904. *Aeschna cornigera* Ris, Hamburg. Magalh. Samm. Odon.: 23 (Brazil).¹⁶
 1905. *Aeshna cornigera* Calvert, Biol. Centr.-Amer. Neur.: 182 (Brazil Paraguay).¹⁷
 1907. *Aeschna cornigera* Foerster, Ent. Wochenbl. (Ins. Borse) 24 (37): 163 (Paraguay).¹⁸
 1907. *Aeshna cornigera* Calvert, Biol. Centr.-Amer. Neur.: 400 (Rio Janeiro).¹⁹
 1913. *Aeschna cornigera* Ris, Mem. Soc. Ent. Belg. 22: 81 (Argentina).²⁰

1916. *Aeschna cornigera* Navas, Broteria, Zool. 14 (1): 17 (Brazil).²¹
 1918. *Aeschna cornigera* Ris, Arch. Naturges. 82 (A) 9: 157 (in part, Bolivia, Argentina, Brazil).²²
 1924. *Aeschna cornigera* Navas, Estudios, Buenos Aires, Mayo 1922: 358 (Argentina).²³
 1927. *Aeschna cornigera* Navas, Estudios, Julio 1927: 23 (Argentina).²⁴
 1933. *Aeschna cornigera* Navas, Revista Acad. Cien. Madrid 29: 54 (Brazil).²⁵
 1947. *Aeshna cornigera* Calvert, Notulae Nat. ANSP 195: 7 (in part, Peru to Argentina).²⁶
 1947. *Aeschna cornigera* Fraser, Acta Zool. Lilloana 4: 446.²⁷

Material studied.—ECUADOR: Abitagua, 1100 m., 13.IX.39, 3 ♂, 1.X.39, 1 ♂, 5.XI.39, 1 ♂, 12.XII.39, 1 ♂, 30.XII.39, 1 ♂, 1 ♀, Balzapamba, 27.IV.38, 1 ♂, William Clarke MacIntyre, in coll. Kennedy. PERU: vicinity of Rio Balsas, Marañon, Dept. Cajamarca, Andes, 1179 m., June 27, 1936, 1 ♂, vicinity of Llangua River, Lallanga, same dept., June 13, 1936, 1 ♂, vicinity of Guayabamba, Dept. Amazonas, Andes, 1300 m., Agos. 14, 1936, 2 ♂, 1 ♀, Felix Woytkowski, UM; La Merced, P. C. Biol. Serv. Rivas, 2 ♀, coll. Kennedy, La Merced, Chancamayo 1 ♀ no. 4997, and Rio Perené 1 ♂ no. 5468 by Dr. P. Martin, coll. Cowley; Colonia del Perené, San Juan trail, alt. estim. 3500 ft., June 16, 1920, "associated with [psilus]," J. H. Williamson, 1 ♂, UM. BOLIVIA: near Coroico, June 4, 1899, W. J. Gerhart, 1 ♂, ANSP; Prov. Chapare, Dept. Cochabamba, II. 1930, 1 ♂, III.1930, 1 ♂, IV.1935, 1 ♂ Coll. Fr. Steinbach in coll. Kennedy. Songo, 1 ♂, Staudinger Vd., det. Cowley, coll. Cowley (see Remarks, page 38). ARGENTINA: Misiones, 21.III.1909, Joergensen leg. *Aeshna cornigera* Ris det. P. Esben Petersen ded. II.37, 1 ♂ in coll. E. Schmidt; Tapia (Tucumán), Avril, 600 m., Baer, Avril, 1903, 1 ♂, (handwriting of the label resembles that of René Martin) in coll. Needham; Salta San Lorenzo, 1400 m., 4.II.48, 1 ♀ and Tucuman, 23.III.40, 1 ♀, both by Wilink in Mus. Univ. Tucumán. PARAGUAY: Sapucay,¹⁷ Nov. & Dec., '99, by W. T. Foster, 3 ♂, USNM, 1 ♂ ANSP. BRAZIL: Porto Cachoeiro do Santa Leopoldina, Carlos Othon, 1 ♂ "*Aeschna cornigera*" in Foerster's handwriting, UM: Südhang Itatiaya-Gebirg 700 m., Rio de Janeiro, Zikan leg. (X.31), 1 ♂, in coll. E. Schmidt; Nictheroy, 19.X.1924 ex coll. Lind., 1 ♂, in coll. Geijskes; Rio de Janeiro Sep. 14, 1922, J. H. Williamson, 1 ♂, UM, 1 ♂, Nov., MCZ no. 184, 2 ♂, nos. 216, 217, AMNH; São Paulo 1 ♂ no. 1779, "det. Cowley" in coll. Cowley (thorax in bad condition, my identification may not be correct), 1 ♂ ex coll. Staudinger in coll. Geijskes, 1 ♀, no. 198, Oct. 19, 1900, A. Hempel ANSP; Indiana, Jan., [1]935, Bo[ugh]t from Sao Paulo Estab. Nat. Sci. Ltd. 1 ♂ in coll. Kennedy; Jaragua do Sul, Santa Catharina, 850 m., Fritz Hoffmann 1 ♂, in coll. E. Schmidt; Nova Teutonia, 27° S. 52°-53° W. in Santa Catharina, Fritz Plaumann, every month from Nov. 2 to April 22, 1934-43, 19 ♂ 1 ♀ in coll. Kennedy, 6 ♂, 3 ♀, in coll. P.P.C. (ANSP), no definite locality

same State, Michelis, ex Mus. Berlin, 1 ♂ in ANSP; Rio Grande do Sul, 1 ♂ no. 4359, Staudinger Vd. in coll. Cowley (colors too faded for positive identification), near Cocheira [Cachoeira?] Rio Grande do Sul, Dec. 19, 1925, Rev. W. F. Wenninger, 1 ♀, Bo[ugh]t by J. S. Hine, willed to Ohio State Archaeol. Mus., presented to C. H. Kennedy, in coll. Kennedy. URUGUAY: Buschental, Dept. S. Jose, Nov. & Dec., 1934, 2 ♂, Aigua, 30 Dec., 1935, 1 ♂, H. Schneider, coll. Cowley. Total 65 ♂, 13 ♀.

Of uncertain determination: Venezuela, Mt. Roraima, 8600 ft., XI. 19, 1927, 1 ♀, AMNH Dept. Invert. Zool. Acc. 29780, Tate no. 12. See postea. *Aeschna* sp? Det. by J. G. Needham.

Distribution.—From 1° 35' South Latitude in Ecuador to 35° S. in Uruguay, and from 52° West Longitude in Brazil to 78° W. in Ecuador. As remarked for *cornigera cornigera*, the area of distribution of *c. planaltica* does not correspond with that of any one proposed zoogeographical province; it falls within the Central and Northeastern provinces of Eigenmann and Allen 1942, Univ. Kentucky, Lexington, Ky., pp. 40-41.

Altitudinal Range.—The collectors' altitudes give the following ranges: in Ecuador, 700-1200 m. (2300-3937 ft.), in Peru 1066-1300 m. (3500-4265 ft.), in Argentina 600-1400 m. (1968-4593 ft.), in Brazil 850 m. (2788 ft.) to sea-level (Rio Grande do Sul), in Uruguay down to sea-level. The ranges so obtained fall within the Tropical faunal zone of Ecuador based by Chapman (1926 as reprinted by Brown 1941) on the avifauna. This corresponds to the Equatorial Hot, Tropical Hot and part of the Interandine natural regions of Acosta Solis (1944).

Seasonal Range.—The fullest data are those for Abitagua, Ecuador, September to December, and for Nova Teutonia, Brazil, November to April. Rainfall data for these two localities seem not to exist. The nearest for Nova Teutonia are those for Blumenau (Hann, Meteor. Ztschr. 28: 324, 1911). Approximate correlations of the flight period of this subspecies with the rainfall seasons are furnished by Kendrew's maps (The Climates of the Continents, 1930, pages 309-311), the flight period occurring in the rainier season in mountainous Ecuador, while in southeastern Brazil and Uruguay the rainfall is "well distributed over the whole year." The Peruvian localities fall within the Fluvial Yunga and Ruparupa (or High Forest) regions of Pulgar Vidal (1941, Bol. Mus. Hist. Nat. Javier Prado 5 (2): 145-160).

♂. Upper part of anterior surface of frons reddish brown or purplish, fronto-clypeal suture most frequently dark brown (44% of 16 individuals), sides of the stem of the black T-spot converging cephalad or subparallel, bordered by a pale yellow or green area which is narrower than the stem and is followed laterad by greenish- or greyish-blue which may or may not, in the same geographical locality (Nova Teutonia), be continued on to the anterior surface of the frons; the bordering yellow or green grades into the greenish-blue which follows it laterad in moderate light but in strong light the contrast between the yellow and the greenish-blue is weakened. Labrum faintly blue, or with some pale brown along the distal margin, labium pale blue, or with reddish-brown distally. Occiput pale bluish, hind margin straight, lateral angles black, rear of eyes black.

Green antehumeral stripe as stated for *c. cornigera*, width at mid-height .82 (Nova Teutonia)-1.14 mm. (Rio de Janeiro), maximum width 1.23 (Nova Teutonia)-1.55 mm. (id. & Rio d. J.). The minimum widths of the green mes- (.33-1.06 mm.) and met- (.41-.82 mm.) epimeral stripes correspond to the deep indentations of the anterior margin of those stripes.

Auricles of abd. seg. 2, and anterior lamina as for *c. cornigera*; posterior end of hamular process narrower than in *c. cornigera* and in Sapucay males the process longer antero-posteriorly. The penis of no. 225 from Nova Teutonia, Brazil, 22 April, 1936, was treated with potash hydrate and is, in comparison with the treated Colombian male no. 240 (fig. 116, pl. IX) of *c. cornigera*, not as much contracted in its apical (distal) half, relatively less expanded at mid-length, the right half less expanded and more irregular in the distal half of its length than in the left half, the two divisions at the apex more divaricate for a greater depth than in the treated no. 240 and untreated no. 237 males from Colombia; the "wings" are nearly as in the drawing of untreated Colombian male no. 237, this perhaps due to the glans of no. 225 lying in the glycerine so that it presents a more completely ventral view. On the whole, the outline of the *c. planaltica* penis, no. 225 is quite close to that of the *c. cornigera* penis no. 237, but I think that the differences between no. 240 (Colombia) and no. 225 (Brazil) can not be taken to be geographical. Male no. 251 from Nova Teutonia, Brazil, has a hardened yellow cord, 5.72 mm. long, and up to 1 mm. thick, projecting caudad from between the parameres of abd. seg. 9, presumably a hardened mass of spermatid fluid. The mid-dorsal tooth of abd. seg. 10 of a Nova Teutonia male is more acute than that of the Buschental, Uruguay, male shown in fig. 121, pl. X.

Superior appendages in a male from Buschental, Uruguay, figs. 121, 122, pl. X, compared with figs. 102, 103, pl. IX, of *cornigera cornigera*, from Colombia, in dorsal view, taper more gradually to the apex which, in profile view, is directed a little more caudad. Males from Guayabamba, Peru, Sapucay, Paraguay, and Nova Teutonia, Brazil, in dorsal view, have the superiors more slender, the apices less tapering, the terminal spine less developed, the concavity of the inner margin shallower, even almost straight to barely convex; in

profile view the appendage as a whole is a little straighter, the superior longitudinal carina lower, its maximum height, above the lateral edge of the appendage as a base line, .24-.45 mm., the distance from the proximal end of the carina to the apex of the appendage 1.55-1.96 mm., the apex not or barely hooked. A male from Indiana, Brazil, has the terminal spine more hooked than is shown in fig. 121, pl. X. The inferior appendage is more slender than in *c. cornigera*.

Wings not colored or only faintest trace of yellow at extreme base (N. Teut. no. 226), or most of wings faintly smoky, each antenodal bordered a little more deeply (Abitagua no. 260), or faint smoky yellow from base to apex, costa to media, darker along each cross-vein (Nova Teutonia no. 250); stigma above dragon's blood or dark indian red, below brown ochre (Nova Teutonia); above cologne earth, below dragon's blood (Abitagua); membranule dark brownish grey, narrowly whitish along vein A or basal fourth to three-fifths white (Nova Teutonia), or basal third white (Rio de Janeiro).

♀. Differs from the male as follows: In a female (no. 230) from Nova Teutonia the pale green bordering the stem of the T-spot of the frons is not sharply distinct from the following greenish spot; in the female from Cachoeiro, Rio Grande do Sul the yellow bordering the stem of the T-spot is followed by a very dark blue, almost black, larger area which is sharply distinct from the lateral yellow of the frons bordering the eye; labrum cream color, or pale brown, or greenish with pale brown distally; genital valves reaching to or beyond the level of the hind end of the tergum of abd. seg. 9; lateral plates of ovipositor to beyond the level of mid-length of the genital valves; anal appendages shorter than segs. 8 + 9 + 10; coloring of the wings variable, the following conditions exist in the present material: pale yellow at extreme base, no other coloring (La Merced, Peru, no. 4997, Nova Teutonia no. 229); no yellow, slightly smoky costa to radius beyond nodus (N. Teut. no. 231); pale yellow to second thickened antenodal, faintly smoky elsewhere, front and hind wings (Abitagua, Ecuador, 30.XII.39); pale yellow at base, but not as far as arculus, and somewhat smoky throughout, front and hind wings yellow in costal area from nodus to stigma and in subcostal area for the last 3-4 antenodals (N. Teut. no. 230). Stigma (Nova Teutonia) above burnt sienna, below van dyke brown, or above pale cadmium yellow, below pale clay yellow, or above brown ochre, below cadmium yellow. A female from Nova Teutonia has the basal 3/5 of the membranule white.

Dimensions.—Total length ♂ 50-60 mm., ♀ 59-62; abdomen (excl. apps.) ♂ 35-44, ♀ 38-42; sup. apps. ♂ 4.50-5.97, ♀ 3.52-6.80; hind wing ♂ 35-42, ♀ 39-42; stigma of front wing, costal edge ♂ 2.37-2.70, ♀ 2.62-3.19. Front wings with 14-18 antenodals, 9-12 postnodals, hind wings with 9-13 antenodals, 11-14 postnodals.

Ecology.—Following are the collector's (Mr. Felix Woytkowski) notes on the male from the vicinity of the Balsas River, 1179 m., June 27, 1936: "Taken in high mountains along a shrub-covered ditch

while flying to and fro." The notes quoted on page 42 from the same collector on the female of *c. cornigera* taken at the same place only two days earlier and in the same environmental conditions, suggest that here the two subspecies not only meet but also may interbreed.

The envelope containing the Llangua River male has the following note on the inside by the collector, Mr. Felix Woytkowski: "The only specimen of the species, common in Celedin, which I took in Llangua. Got frightfully black." No Celedin specimens of *cornigera* have been seen by me. Mr. Woytkowski may have been thinking of *Ae. marchali* of which I have seen 24 ♂, 9 ♀ taken by him at Celedin May 25 to July 6 of the same year, 1936. The envelope of one of the males from Guatabamba bears Mr. Woytkowski's note: "Fairly scarce here. Taken over boggy brooks on the open meadow."

The Zikans give the following description of the mountain region north west of Rio de Janeiro in the Introduction to their catalogue of the insect fauna of Itatiaya and Mantiqueira 1940 * (translated): The region under consideration is situated on the mountain of Itatiaya to the north of the place Campo Belo, constituting a forest reserve of the Union, declared a National Park by the law of 1937. It is formed by a valley cut out by the Rio Campo Belo, which arises in a basin at the base of the Agulhas Negras, the culminating point of the Serra do Itatiaya. In its upper part it is subdivided into numerous deep grottoes each one feeding an arroyo or rivulet. The flanks of the mountain are covered with virgin forest. The region can be divided into four vertical zones, the first zone corresponding to the valley of the Rio Paraíba up to the foot-hills of the mountain, the second goes up to the bridge of Maromba, the third extending from Maromba as far as Maceiras, and the fourth comprehending all the planalto including the culminating peaks. Zikan's Itatiaya male of *c. planaltica* was taken at 700 m. which is in their second zone thus described: from the base of the serra to 1,100 m. where the Maromba empties into the Rio Campo Belo; slopes of the hills covered with vegetation, the rainy subtropical forest. Additional notes on Brazil are given anteà, page 31 under *Ae. (H.) confusa*.

* Rodriguesia, Rio de Janeiro 4 (13) pp. 155-6.

Discussion.—Variations in the number of cells in the anal triangle of the hind wings of the male and in the maximum number of rows of cells between the fork of Rs under the stigma in both front and hind wings of both sexes, such as were presented for *c. cornigera* on page 43 are as follows: Out of 62 males, 11 females of *c. planaltica* three cells were found in the anal triangle of 61 males (99.2%) and two cells in one hind wing of one male (.8 of 1%); a maximum of three rows of cells in the fork of Rs was found in 93.6% of front wings of males and 100% of females, in 88.7% of hind wings of males and 100% of females; 5.6% of male, but no female front wings and 10.5% of male and no female hind wings had a maximum of four rows of cells in the fork of Rs under the stigma; .8 of 1% of male front wings and .8 of 1% hind wings had a maximum of two rows of cells in the fork of Rs under the stigma. The figures here given differ from those in our Table 14 in that here the sexes are tabulated separately while in Table 14 the sexes are tabulated together for the rows of cells in the fork.

In two males all four wings have four rows of cells in the fork, two males have four rows in one front and both hind wings, one male has four rows in one front and one hind wing, one male has four rows in both hind wings and one male has four rows in one hind wing; all the males listed in this paragraph are from Nova Teutonia, Brazil.

The name *planaltica* refers to the area Plano Alto as shown on maps, pls. xi and xii of Haseman's "Some Factors of Geographical Distribution in South America" (Annals New York Acad. Sci. xxii, 1912). H. C. Gilson (Trans. Linn. Soc. London (3) 1 (1) p. 7, 1939-40) defines the Altiplano of Peru and Bolivia thus: "Between latitudes 14 and 22 S., in southern Peru and southwestern Bolivia the two main ranges of the Andes enclose the basin known as the Altiplano". Carlson (Geography of Latin America New York: 1943, Prentice-Hall, Inc., page 219) has a similar usage.

The female from Mt. Roraima, Venezuela, doubtfully referred to *cornigera planaltica* at the end of our list of material studied, is from a locality almost equally removed from the two nearest stations known for *planaltica*, viz., Abitagua, Ecuador, and Porto Cachoeiro do Santa Leopoldina, Brazil. It has the dark line on the fronto-clypeal suture not distinct, pale thoracic stripes and abd. segs. 8 and 9 faded, no suggestion of blue on the ventral surfaces of abd. segs. 9 and 10, triangle

of the hind wings 5-celled with 2 cells on the proximal side, anal appendages very little shorter than abd. segs. 9 + 10, apex rounded, inner margin widened at $\frac{1}{4}$ length, slightly narrowed at $\frac{3}{4}$ of its length, mid-way between these two points almost subparallel to the outer margin; abd. seg. 10 with a low mid-dorsal carina for entire length of segment, on each side of the carina, in the anterior fourth of the segment, two slight convexities; abdomen (excl. apps.) 52 mm., sup. apps. 3.6, hind wing 45 mm.; front wings with 17, 19 antenodals, 13 postnodals, hind wings with 11, 13 antenodals, 17, 16 postnodals, width of frons 5.32 mm., of head 9.8 mm., membranule grayish brown, no white, pterostigma, front wing, costal edge 2.78 mm.

- Ae. (H.) psilus** Tables 1, 3, 5, 6, 10, 12, 15; Pl. XXXI; Map 2.
 1947. *Aeshna psilus* Calvert, Notulae Naturae Acad. Nat. Sci. Phila. 194: 4, fig. 2 (δ genit.).¹
 1905. *Aeshna cornigera* Calvert (not Brauer) Biol. Centr.-Amer. Neur. pp. 179-182, 400 (pars, Mex.).²
 1918. *Aeschna cornigera* Ris (not Brauer) Arch. Naturgesch. 82 Abt. A (9): 157 (pars, prob. some Mex. & Costa Rican examples).³
 1930. *Aeshna cornigera* E. B. & J. H. Williamson (not Brauer), Occas. Papers Mus. Zool. Univ. Mich. 216: 32, 33.⁴
 1932. *Aeshna cornigera* Klots (not Brauer), N. York Acad. Sci., Sci. Survey Porto Rico etc. 14 (1): 18 (Cuba, Porto Rico; thanks to Mrs. Klots I have examined the two [males] cited).⁵
 1938. *Aeschna cornigera* Garcia-Diaz (not Brauer), Journ. Agric. Univ. Puerto Rico 22 (1): 55 (Puerto Rico; the same male as that cited by Mrs. Klots which I have examined).⁶
 1943. *Aeschna cornigera* Whitehouse (not Brauer) Bull. Inst. Jamaica Sci. Series 3: 7, 2 figs. (color patterns δ & η).⁷
 1955. *Aeschna psilus* Needham & Westfall, Man. Drgfls. N. Amer. 290-4, 296, fig. D (labial palp nymph), 312, fig. 191 (apps. δ).⁸

Material studied.—MEXICO: Chichen-Itza in Yucatan, Feb. 5, 1930, F. M. Gaige, 1 δ UM, Aguascalientes City, Aug. 27, 1906, P. P. Calvert, 1 δ ANSP, Tepic, Nov. 5, 1923, J. H. Williamson, 1 δ UM, Guadalajara, Sept. 11, 1903, J. F. McClendon, 1 η ANSP, region of Lake Chapala, Dec. 5, 1923, 5 δ and San Diego Rancho near Cocula, Jalisco, Nov. 12-15, 1923, 4 δ , 1 η , by J. H. Williamson, UM, Cuernavaca, June, O. W. Barrett, 1 δ , Texolo, 3.13.99, S. N. & M. C. Rhoads, 1 δ , and Atoyac, Schumann 1 δ , in Vera Cruz, ANSP. GUATEMALA: El Fiscal, Dept. Guatemala, June 3, 1909, E. B. Williamson, 3 δ UM. COSTA RICA: near Rio Turrialba, 2000 ft., July 24, '09, 1 η , Juan Viñas (formerly Inferñillo), laguna, 3300 ft., Mar. 19, 1910, 2 δ , and Reventazon valley, 2500 ft., July 28, 1909, 2 δ , Cachi, stagnant pool, bank of Rio

Reventazon, Mar, 10, 1910, 1 holotype, all by P. P. Calvert, ANSP; San Jose, 1160 m., 1.6.29, M. Valerio, 1 ♀, im Hause oder im Zimmer, 17.VI.1937, 1 ♂, 16.II.1937, 1 ♀, Ferd. Nevermann, coll. E. Schmidt, no definite locality, Van Patten, 1 ♂ in bad condition, USNM, road San Jose to La Verbena, May 16, 1909, 1 ♂, P. P. Calvert, ANSP. PANAMA: El Volcan Chiriqui 19.II.1936, F. E. Lutz, 1 ♀ AMNH. ECUADOR: Rio Jotún Yacu, Rio Napo, 700 m., 24.II.37, 1 ♂, and LaPalmera, 1300 m., 9.XII.38 R, 1 ♂, W. Clarke MacIntyre, coll. Kennedy; PERU: La Merced, P. C. Biol. Serv. Rivas coll. 2 ♂, and Satipo, Pedro Paprzycki, 24 May, 6 Jun, 1940, 2 ♂, coll. Kennedy, Campamiento del Perené, Jun 6-22, 1920, 7 ♂, and Colonia del Perené, San Juan trail, alt. estim. 3500 ft., Jun 16, 1920, 1 ♂ "associated with large nearly related sp." (*cornigera planaltica*, see page 44), J. H. Williamson UM. WEST INDIES: Cuba, Santiago, 1 ♂. Puerto Rico, Adjuntas, VI.8.13, 1 ♂, AMNH, Jamaica, Cinchona, 5000 ft., July 7, 1948, C. Bernard Lewis, 1 ♂, ANSP. Total 43 ♂, 6 ♀.

Distribution.—From 22° North Latitude in Mexico to 11° South Latitude in Peru; not known east of 70° West Longitude in South America; Cuba, Jamaica and Porto Rico in the West Indies.

Altitudinal Range.—From less than 600 to ca. 6000 ft. (200 to 1800 m.) in Mexico, 2000 to 3800 ft. (600 to 1160 m.) in Costa Rica; in Ecuador at 4265 ft. (1300 m.), in Peru at 3500 ft. (1067 m.), in Jamaica 3500-5000 ft.⁷ (1524 m.). The Mexican localities are chiefly in the Tierra Templada, but one (Chichen-Itza) is in the Tierra Caliente.

Seasonal Range.—In each of the Mexican localities only a single capture of *psilus* is known; the dates of these fall in the drier months at Tepic, Lake Chapala, Cocula, Texolo and Chichen-Itza, in the rainier months at Aguascalientes, Guadalajara and Cuernavaca, according to the data assembled by Page (1930 *). In Costa Rica *psilus* has been collected at San Jose in May and June, rainier months, and in December and February, drier months; March at Cachi and Juan Vinas is a drier month, July at Turrialba and Juan Vinas is a rainier month (Reed † 1941, page 1224).

♂. Sides of the black or dark brown stem of the T-spot of the frons parallel or converging cephalad (concave Porto Rico), stem bordered each side with a pale green or yellow area, narrower than the stem, followed by a larger greenish- to grayish-blue spot which is distinct from the pale green or yellow

* Monthly Weather Review, Supplmt. No. 33, U. S. Dept. Agric., Washington, pp. 15-28.

† Climate and Man, Yearbook of Agriculture, U. S. Dept. Agric., Washington, pp. 673, 1224.

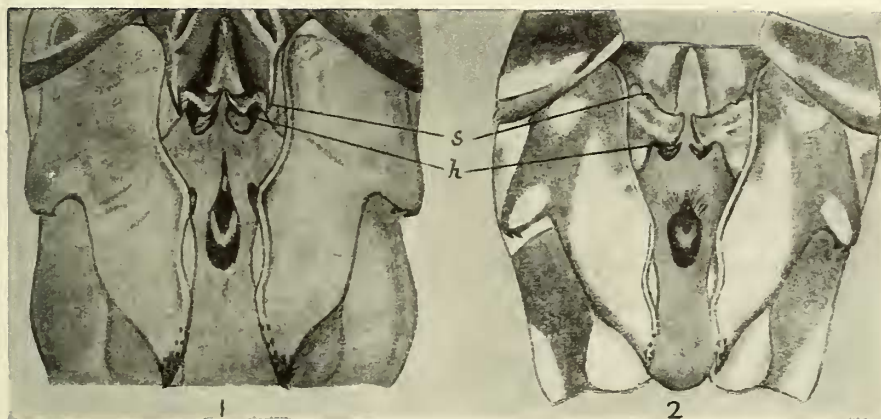
of the lateral surface of the frons adjoining the eyes; this spot may or may not be continued on to the anterior surface of the frons; when this bluish spot is not continued on to the anterior surface of the frons, the upper half, or less, of the said anterior surface is usually a reddish brown, but the reddish brown is sometimes present (Santiago de Cuba) even when the bluish spot is continued as described.

Green antehumeral stripe reaching upward almost to the antealar sinus, width at mid-height .82-1.18 mm., usually wider, 1.00-1.56 mm. at upper end, although not so in the holotype or in the Jamaican male. Epimeral stripes pale blue or greenish blue, widest at upper end, each usually with a slight concavity on its anterior margin above mid-height.

Auricles of abd. seg. 2 green with black or dark brown margins, two teeth on the hind margin. Anterior lamina with a very short spine each side whose apex does not reach to the level of the hamular process, text figure 2. Penis: 1st segment (genital vesicle) ventral margin angulate, fig. 421, pl. XXXI, at a little posterior to mid-length, anterior limb concave, 1.13 mm. long, posterior limb nearly straight, .85 mm. long; 2nd segment, maximum length in a straight line 1.04 mm., proximal end a little thicker than distal end, a constriction near mid-length; 3rd segment, maximum length .94 mm., proximal end .33 mm. thick, distal end .19 mm.; 4th segment, maximum length, excluding the median ventral proximal lobe, .9 mm., with a thin, triangular, latero-dorsal, proximal lobe each side and a longer (.24 mm. long) median ventral proximal lobe which, in profile view, tapers to a slender acute apex, fig. 421; in ventral view, fig. 420, the 4th segment, or glans, is triangular, its proximal margin .80 mm. long, forming with each lateral margin an angle of 90°, lateral margins parallel with each other for .25 mm., thence converging distad to a rounded apex .19 mm. wide; a slight median notch at the distal end of the median longitudinal groove; total length of each lateral margin .94 mm.; dorsal surface for its entire visible length with a deep median longitudinal groove on each side of which is a convex longitudinal ridge.

Spinules on the ventral tubercle of abd. seg. 1 20-40 in number, the longest (ca. .09-.12 mm.) are paramedian (Colonia de Perené) or lateral (Porto Rico). Genital lobe of the 2d abd. seg. with an anterior group of five larger (.05 mm.) and a posterior group of five smaller spinules (ca. .025 mm.), both groups lying in the dark-colored ventral margin of the genital lobe (Colonia de Perené) or the anterior group of about ten, the posterior group of about five spinules .08 mm. long (Santiago de Cuba), or the two groups combined into one of about six spinules .03-.04 mm. long (Porto Rico), or of 10-19 spinules .05-.07 mm. long (Costa Rica).

Superior appendages, in supero-internal view, with the inner (mesal) margin in the middle third of its length parallel to the outer margin; in profile view no subbasal inferior tooth or tubercle, the extreme apex bent strongly ventrad at about 90°, acute, hooked. Inferior appendage slightly less than half as long as the superiors, triangular in dorsal or ventral view.



Ventral surface of second abdominal segment $\delta \times 12$.

Aeshna (Hesperaeschna) cornigera cornigera Brauer 1865.

Aeshna (H.) psilus Calvert 1947. *s* spine of anterior lamina, in fig. 2 rudimentary. *h* meso-posterior angle of hamular process.

Wings variable in coloring: (a) not colored, or (b) very faintly yellow at extreme base (Juan Vinas); or (c) very pale yellow along costal margin to nodus (R. Jotún Yacu, Ec.); or (d) faintly milky throughout (Colonia de Perené); or (e) faintly smoky throughout (id., El Fiscal, Guat.); or (f) faintly smoky throughout and with each ante- and each post-nodal margined with obscure yellowish (J. Viñas, La Merced, Ec., Col. Perené, Peru), or (g) only the antenodals so margined (Satipo, Peru); or (h) pale smoky in the apical half, especially along the hind margin (Lake Chapala). Stigma burnt siena above, cadmium yellow below, or cadmium yellow above, paler below, or brown ochre, paler below. Membranule grayish brown, narrowly whitish along vein A.

♀. Differs from the male as follows: The female from Guadalajara, partly faded, abd. seg. 2 compared with fig. 416, pl. XXXI, apparently lacks an anterior arm from the pale antero-lateral spot (AL), the posterior arm is unbroken, the postero-dorsal (PD) and postero-lateral (PL) are barely separated, PL and the medio-lateral (ML) are partly separated on the ventral edge, ML is confluent with AL below the ventral end of the transverse median carina, the ventral spots are ill-defined. Ovipositor reaching caudad to beyond the level of the hind end of the inflexed tergum of abd. seg. 9, genital valves reaching almost to that level, lateral genital plates to slightly less than half that level; hind margin of basal plate of ovipositor convex. Wings variable, colored like a, of the male, or pale yellow at base to triangles, elsewhere uncolored (Guadalajara Turrialba, S. Jose), or like b of the male (S. José), or like e of the male (San Diego).

Dimensions.—Abdomen (excl. apps.) ♂ 36.5-41 mm., ♀ 41-43, hind wing ♂ 35-41, ♀ 40-43, sup. apps. ♂ 4.90-5.90, ♀ 7.28-8.26, pterostigma, front wing, costal edge ♂ 2.21-2.62, ♀ 2.78-3.03 mm. Front wings with 16-19 antenodals, 10-12 postnodals, hind wings with 9-11 antenodals, 11-14 postnodals.

Living colors.—The following notes, presumably by Mr. J. H. Williamson, are on envelopes of specimens taken in Mexico by him. Tepic, Nov. 5, 1923, ♂ "blue below at tip of abdomen"; San Diego Rancho, Nov. 12, 1923, ♂ "eyes brown and gray and blue, face blue, thorax brown with green stripes, abdomen black on top with green on 1, blue on 2, green dots on 3-9, blue on 10, blue beneath on last $\frac{1}{2}$ of 9 and 10, blue marks on 2, 3, 7 and 8, others (4-6) green marks; San Diego Rancho Nov. 13, 1923, 2 ♂, "face, thoracic stripes and abdominal spots blue."

The following notes were made by the writer on the living colors of the holotype male of Cachi, March 10, 1910: eyes green above with two transverse dark brown stripes, lower half paler brownish-green anteriorly, posteriorly bright blue; three horizontal rows of blackish pseudopupillae; labium, posterior small spot, the pale markings of the posterior dorsal half of abd. seg. 2, a spot immediately above each auricle and the inferior lateral margin of the same segment bright blue; all the other pale markings of the body green, including the antehumeral (3 mm. long, .8 mm. wide), mesepimeral (1 mm. wide) and metepimeral (1 mm. wide) stripes, markings on the anterior dorsal half of abd. seg. 2, on segs. 1, 3-10 (except that there is a blue anterior lateral spot on 3 margined with green).

Ecology.—The following notes are by Mr. J. H. Williamson on Mexican examples caught by him: Tepic ♂, Nov. 5, 1923, "caught circling the walled-in spring"; San Diego Rancho 2 ♂, Nov. 13, 1923, "nosing around in dusk in mud-bottom creek where foliage was thickest"; region of Lake Chapala 2 ♂, Dec. 5, 1923, "caught nosing along banks of big pools where shade was thickest at all hours from 11 A. M. till 3.30 P. M." By the same collector in Peru are these: Colonia del Perene, June 10, 1920, "caught soaring on trail near quebrada" and June 18, 1920, ♂, "see exuvia, same place and date. Note, left with Prof. Needham at Cornell University." The present writer made this note on the two males of *psilus* taken at the laguna, Juan Vinas, Costa Rica, March 19, 1910, between 12.30 and 4.50 P. M. "along draining ditch of south and west sides, sunny and cloudy alternately, light wind, 2 ♂ taken, others seen, chiefly flying 4-10 inches above the water in the ditch." Associated with *psilus* at this ditch were the following Odonata: *Hetaerina cruentata* 1 only, *Argia extranea* and *johannella*, *Anisagrion allopterum* and *rubicundum*,

Acanthagrion gracile, *Telebasis* sp., *Anomalagrion hastatum* 1 ♂, *Coryphaeschna luteipennis*, [*florida*] *Libellula foliata* and *herculea* 1 each, *Orthemis ferruginea*, *Micrathyria didyma* and *Erythrodiplax connata*, both red-fronted and blue-fronted forms. We have described the conditions at Juan Vinas elsewhere (1917 * chaps. ix-xiii). It will be noticed from the above list of material studied that this species has been taken indoors at San Jose. Of the male from Cinchona in the Blue Mountains of Jamaica, Mr. C. Bernard Lewis wrote, July 8th, 1948, "I am sending you a specimen of the *Aeschna* . . . I was only able to obtain a male. . . . these dragonflies breed in an artificial open cistern at Cinchona located at 5000 feet. This is probably the only breeding pool in the area unless the species is capable of breeding in swiftly flowing mountain streams. I am rather inclined to doubt this as it is almost never seen far from the above-mentioned cistern."

Discussion.—Of 34 ♂, 5 ♀, of *psilus* checked with our key to the neotropical species, pages 9-11, only one hind wing of one male (Adjuntas, Porto Rico = 1.5%) has four rows of cells in the fork of Rs under the stigma; all the males and all the females have three rows of cells in the front wings (100% ♂ ♀), 1.5% ♂ and 0% ♀ hind wings have four rows in the fork. All 34 ♂ and 5 ♀ have the proximal side of the discoidal triangle of the hind wings more than half as long as the posterior (or distal) side and three vertical rows of cells in the anal loop. All 34 ♂ have the anal triangle of the hind wings 3-celled.

I compared (a) the Jamaican male sent by Mr. Lewis with (b) the description and figure of the living colors of this species given by Mr. J. C. Jury in Whitehouse⁷ and noted these differences: a has the pale mesepimeral stripe concave anteriorly in its upper half while b has it convex; a has the pale metepimeral stripe concave anteriorly in its upper two-thirds, b has it convex in its upper half; a has the T-spot of the frons as described for the female of b; the colors of abd. segs. 1 and 2 of a were too faded for comparison. The shapes of the epimeral stripes of a are similar to those shown in our figure 414, pl. XXXI, for a Costa Rican male.

* Calvert, A. S. & P. P. 1917, A Year of Costa Rican Natural History, New York, Macmillan.

Ae. (H.) manni

- Tables 1, 3, 5, 6, 10, 12, 15; pl. XXV, figs. 328-338; Map 2.
 1930. *Aeshna manni* E. B. & J. H. Williamson, Occas. Papers Mus. Zool. Univ. Mich. 216: 26, pl. III, figs. 23-29 (♂ ♀).¹
 1895. *Aeschna cornigera* Calvert (not Brauer), Proc. Calif. Acad. Sci. (2) iv: 507, pl. XV, figs. 24, 31, 32 (♂ details).²
 1947. *Aeshna manni* Calvert, Not. Nat. Acad. Nat. Sci. Phila. 194: 8.³
 1952. *Hesperaeschna manni* Calvert, Ent. News 63: 254.⁴
 1955. *Aeschna manni* Needham & Westfall, Man. Drgfls. N. Am.: 290, 291, 293, 294, 308.⁵

Material studied.—MEXICO: Baja California, Los Parres, Oct. 8, 1923, Palmarita water hole, 1 ♂ "Aeshna manni paratype" in E. B. Williamson's hand, UM; Baja California, no further locality, "from Harbison of San Diego" teste Needham, 1 ♂ coll. Needham. San Raymundo, April, 1889, C. D. Haines, 1 ♂ very much faded ANSP. Total 3 ♂.

Distribution.—Not known outside of Baja California.

Altitudinal Range.—In the belt of 500-1000 m. (1640-3280 ft.).

Seasonal Range.—April to October.² *

♂. Sides of the black or dark brown stem of the T-spot of the frons parallel or converging cephalad, bordered laterad with pale yellow which is narrower (Palmarita) or wider (Harbison's ♂) than the stem and is followed laterad by a larger greenish-blue area which is continued on to the anterior surface of the frons but is sharply distinct from the pale yellow which borders the eye-margin. Fronto-clypeal suture with a pale brown line. Occiput pale blue or yellow, lateral angles black, hind margin slightly concave or almost straight. Rear of eyes black.

* Page, in his description of the climate of Mexico, Monthly Weather Review, Supplmt. No. 33, U. S. Dept. Agric., Washington, 1930, says, p. 19: "The region bordering the northern part of the Gulf of California including much of the Peninsula of Lower California, is a desert region and is here called the desert rainfall province. . . . No month has more than 12 mm. for the region as a whole, though there appear to be areas which because of relief and exposure have a considerably heavier rainfall. . . . The average rainfall for the region, based on records for three stations along or very near the coast is 295 mm. . . ." Reed, in Climate and Man, Yearbook of Agriculture 1941, U. S. Dept. Agric., p. 673, gives monthly rainfall data for La Paz, at 24° 10' North Latitude, 110° 21' West Longitude, in the southern part of the peninsula, about 2° latitude farther south than the recorded localities for *Aeshna manni*. His La Paz data, based on eleven years' record, total 5.71 inches (= 137.6 mm.) for the year and the wettest months are July .43 inches, August 1.22, September 1.42, October .59, November .47, December 1.06 inches; April, May and June have respectively 0, 0 and .20 inches. It would appear, therefore, that *Aeshna manni* flies in both the wetter and the drier seasons.

Pale antehumeral stripe yellow or yellowish green or blue,¹ pointed anteriorly, not reaching to the anterior mesepisternal margin, diverging ventrad from its fellow of the opposite side, farther from the middorsal carina than its own width, reaching upward only halfway to the antealar sinus from which it is separated by 2.3-2.6 mm. Epimeral stripes pale blue, widest at their upper ends, narrowest at or near mid-height.

Spinules on the ventral tubercle of abd. seg. 1 about 60 in number, the longest, about .07 mm., are lateral. Auricles blue, margins black or dark brown, with two teeth on the hind margin. Anterior lamina without spines; see footnote to page 26. On abd seg. 2 the lateral blue spot dorsad of the auricle is hardly divided at its dorsal margin into two diverging arms in the *Palmarita* paratype (faded in Harbison's ♂) as it is in *psilus*, in *cornigera* and as it is to a smaller extent in *haarupi*. Cf. figs. 336, pl. XXV, 416, pl. XXXI, 131, pl. X, 237, pl. XVIII. This is the spot described as AML by the Williamsons,¹ p. 28, and figured by Walker (1912, p. 9, fig. 1 (1) as AML for *Aeshna juncea*. It should be remarked that in the four neotropical species here discussed this spot is strictly AL, both arms lying anterior to the transverse accessory carina.

Pale spots on abd. segs. 3-10: MD pale green on 3-6, PD pale blue on 3-10, AL blue on 3 or 5-8, ML blue on 3-8, confluent with MD on 3-4 or 5, PL blue on 3-9, confluent with PD on 3-4 in Harbison's ♂, PMD represented by indistinct reddish brown on 4-7; dorsum of 10 mostly faded blue, all four margins blackish, the anterior most widely so, middorsal carina blackish; ventral surfaces of inflexed terga of 3-7 reddish or brownish streaked with blue, ventral surfaces of 9 behind the parameres and of 10 pale blue.

Penis similar to those of the other three species just mentioned. Superior appendages in supero-internal view, left appendage in fig. 329, pl. XXV, with the inner margin nearly straight in the middle third, not parallel to the outer margin, and the apex acute, not bent mesad or laterad, in dorsal view slightly concave but not parallel to the outer margin, apex nearly 90°, directed laterad; in profile view the extreme apex bent strongly ventrad, acute, hooked, no inferior subbasal tooth or tubercle. Inferior appendage less than half as long as the superiors.

Wings uncolored, venation ochraceous; stigma brown ochre or burnt sienna above, paler or cadmium yellow below; membranule grayish brown, narrowly white along the anal vein (*Palmarita*) or nearly the basal half pale.

Dimensions.—Abdomen (excl. apps.) ♂ 41-43.5 mm., ♀ 44, sup. apps. ♂ 5.15-5.64, ♀ 10¹ (estimated); hind wing ♂ 44-45, ♀ 45, pterostigma, front wing, costal edge, ♂ 2.78-3.27, ♀ 3.33 mm. Front wings with 17-18 antenodals, 10-13 postnodals, hind wings with 9-11 antenodals, 12-13 postnodals.

♀. Differs from the male as follows: mesepimeral stripe "yellow with its upper fourth obliterated except for a small spot near the lateral ridge", metepimeral stripe yellowish green, widest at its upper end and constricted near its middle; "genital valves in ventral view 2.5 mm. long, narrowly elliptical, the apices separated by about half the width of each apex, ventral

surface well defined, generally smoothly convex with a short shallow median sulcus before the apex; a minute brush of hairs just anterior to the postero-ventral angle; style .8 mm. long, and shorter than the dorsum of abd. seg. 10; basal plate of ovipositor with posterior edge nearly straight; lateral plates present."¹

Ecology.—The Williamsons give the following descriptions of the localities whence they obtained *manni*: "Los Parres (or Los Parras?) is a single house back in the hills four or five hours' journey by mule from Loreto, Baja California. Collecting was done along a five hundred yard stretch of mountain creek. Here a dam formed a one hundred fifty foot pool. Above the pool the bed of the creek was dry. Below the dam were little pools of water among the rocks for a few hundred yards down the canyon. Water from the pool was used for irrigating grapes, olives, oranges, date palms, etc." A list of 25 species of Odonata found here is given. "Palmarita is a one house settlement about one day's mule journey from Los Parres. Here a tiny trickle of water ran for about fifteen feet in a creek bed, then formed a pool about two feet in diameter, dug out to obtain drinking water; then a slightly larger pool for washing clothes, and below this, a small swampy area filled with dead fronds from a cluster of date palms. Collecting was done here only from about five p. m. until dusk". Ten species of Odonata are listed as taken here.

Discussion.—In the Williamsons' description,¹ page 27, the lateral thoracic stripes are said to be on the "mes- and metepisternum each", but their figs. 23 and 24, pl. III, show them to be mes- and metepimeral.

Ae. (H.) marchali Tables 1, 3, 5, 6, 10, 12, 15; Pl. XXVI; Map 3.

1842. *Aeschna marchali* Rambur, Ins. Nevr. 203.¹

1861. *Aeschna marchali* Hagen, Syn. Neur. N. Amer. 314.²

1875. *Aeschna marchali* Hagen, Proc. Boston Soc. Nat. Hist. 18: 34.³

1890. *Aeschna marchalii* Kirby, Cat. Odon. 88.⁴

1908. *Aeschna marchali* Martin, Coll. Zool. Selys-Longchamps Cat. Syst. Descr. fasc. XVIII p. 45, fig. 41 (apps. ♂).⁵

1913. *Aeschna marchali* Ris, Mem. Soc. Ent. Belg. 22 p. 83.⁶

1918. *Aeschna marchali* Ris, Arch. Naturgesch. 82 A (9) pp. 158, 159, Taf. II, fig. 104 (venation).⁷

1922. *Aeschna marchali* Campos, Cat. Odon. Ecuad. p. 33, lam 2, fig. 6 (♂).⁸

1923. *Aeschna marchali* Navás, Bol. Soc. Colomb. Cien. Nat. 12 (73) p. 360.⁹

1926. *Aeschna marchali* Campos, Rev. Col. Nac. Vic. Rocafuerte 8 (25-26) p. 7.¹⁰
1928. *Aeshna marchali* Navás, Rev. Chilena Hist. Nat. 32 p. 107.¹¹
1933. *Aeshna marchali* Navás, Rev. Acad. Cien. Madrid 29 p. 54.¹²
1934. *Aeshna marchali* Navás, op. cit. 31 p. 9.¹³
1935. *Aeshna marchali* Navás, Bol. Soc. Ent. Espana 17 (1-3) p. 33.¹⁴
1908. *Aeschna cornigera* Martin, Coll. Zool. Selys-Longchamps Cat. Syst. Descr. fasc. XVIII p. 46, fig. 42 (apps. ♂); ¹⁵ "fig. 42 is not cornigera as labeled, but is probably marchali" (Williamson).
1953. *Aeshna marchali* Rácenis Anales Univ. Centr. Venez. 35; 37, fig. 12 (venation ♂).¹⁸
1930. [*Aeshna*] *marchali* E. B. & J. H. Williamson, Occas. Papers Mus. Zool. Univ. Mich. 216 p. 34.¹⁶
- 1938 (1939?) *Aeschna marchali* Maria, Rev. Chil. Hist. Nat. 42 p. 206.¹⁷
- Material studied*.—COLOMBIA: ¹ no definite locality 1 ♂, 1 ♀ by Felipe Ovalle Q., AMNH Acc. 33501; La Pica, Santander, Feb. 9-19, 1917, no collector's name, 12 ♂, 1 ♀ UM; region of the Cauca River 1 ♀ AMNH; Bogota, 1 ♀ coll. P.P.C. ECUADOR: no definite locality, Prof. Campos, 1 ♂, 1 ♀ in coll. Needham; Cuicocha, Imbabura, 3300 m., 27-31.v.1939, 1 ♂, Pichincha province, 3300 m., 12.xi.1938, 1 ♂, Uyambicho (south of Quito, Brown's map), 2700 m., 18.xi.1938, 2 ♂, Baños, i.1939, 1 ♂, F. M. Brown, AMNH, Acc. 36397; Quito, 2850 m., F. Campos R., 3 ♂, nos. 303, 311, 312, 2850 m., June, Oct. to Dec. 12 ♂, 2 ♀, undated 13 ♂, nos. 301, 302, 304, 306, 307 and no nos., 3 ♂, coll. P. P. C., 1 ♂ UM; Latacunga, 2801 m., June, F. Campos R., 3 ♂, 1 ♀ undated, coll. P.P.C. 2700 m., 23.ii.'39, 3 ♂, Salcedo, near Latacunga, same alt., 24.iii.39, 1 ♂, Baños, no alt. given, 26.ii to 25.iii.'36, 13 ♂, 5 ♀, 1800 m., Jan., March, April, July, Oct. '36-'39, 23 ♂, 2 ♀, Playa of Rio Pastaza at Baños, 1800 m., June, Aug., '36, 7 ♂, 2 ♀, 1900 m., May, June (at Pititi), Sept., 4 ♂, 2 ♀, 2000 m., May, June, '37, '39, 2 ♂, 1 ♀, 2200 m., May, June, '37, '39, 2 ♂, 1 ♀, Baños Runtun, about 2000 m., Feb., July, '35, '39, 7 ♂, 2200 m. Jan. to July, 11 ♂, 6 ♀, 2300 m., Oct., 1 ♂, 2500 m., Dec. '38, 1 ♂, Baños El Arenal, 2000 m., Aug., '36, 1 ♂, Rio Pastaza watershed, Rio Blanco, 2000 m., May, '36, 2 ♂, 1 ♀, Rio Pastaza watershed, Tablon, May, '36, 2 ♂, 1 ♀, 2000 m., Oct., '38, 2 ♀, Rio Pastaza watershed, La Ventana, 2000 m., May, '36, 3 ♂, Rio Pastaza, Sta. Rosa, 2500 m., June, '36, 4 ♂, 1 ♀, 2200 m., May, June, '37, 2 ♂, 3 ♀, Rio Pastaza, Guamo, 2500 m., May, June, '36, 1 ♂, 1 ♀, Rio Pastaza, Agoyan, 1500 m., May, '36, 1 ♂, San Vicente, altitude not given, April, July, Aug., '39, 25 ♂, 1 ♀, 1700 m., 1.vi.'39, 3 ♂, Juives (Baños), 1900 m., July, Oct., '39, '38, 3 ♂, 1 ♀, 1800 m., 25.viii.39, 1 ♂, Rio Pastaza watershed, 2000 m., July, '36, 1 ♂, 2500 m., May, '36, 1 ♀, no alt. given, Jan., Mar. to May, '36, 8 ♂, 1 ♀, Rio Ulva E. of Baños, 1700 m., 24.x.38, F. Martin Brown, 1 ♀, Mt. Tungurahua, 3200 m., Aug. 20, '36, 1 ♀, 3000 m., May 12, '37, 1 ♂, 2800 m., (Pundoa), 17.vii, Mar. 1, '39, 1 ♀, 1 ♂, 2600 m., (Chaupe), Mar. 1, 28, vi, '39, 1 ♂, 1 ♀, Guasuntos 1 ♂ no. 308, 2 ♀, F. Campos R. coll. P. P. C. Patate 1 ♂, 1 ♀, Malacatus, Province Loja, 1500 m., 19.viii.

'41, D. B. Laddey, 1 ♀; specimens Latacunga 2801 m., to here taken by William Clarke MacIntyre and in coll. Kennedy, except where otherwise stated. PERU: San Idelfonso, Dept. Amazonas, July 29, '36, 1 ♂, 1 ♀, half-way between Chachapoyas and Celendin in the Andes, 2900 m., Jan. 2, '37, 1 ♂, vicinity of Viena, Andes, 2600 m., 19-25 April, '35, 1 ♂, vicinity of Limon, 1900 m., July 3, '36, 1 ♀, and Celendin, 2625 m., May 25 to July 6, '36, 24 ♂, 9 ♀, in Dept. Capamarca, Vitoc,* province Tarma, Dept. Junín, 5 and 26 April, '40, 2 ♂, Felix Woytkowski, in coll. Kennedy; Matucana, Dept. Lima, J. H. Williamson, May 26 & 27, '20, 9 ♂, 2 ♀, UM: Marcapata, via Staudinger 1930, 1 ♂ det. E. Schmidt, in coll. Schmidt; Arequipa, Oct. 28, '98, W. J. Gerhart, 2 ♂ ANSP; Chuchurras, 300 m., ex coll. Staudinger, 1 "Aeschna marchali det. Schmidt," coll. Geijskes. Total 232 ♂, 62 ♀.

Distribution.—From Aragua on the north coast of Venezuela¹⁸ and the department of Santander, Colombia, approximately 10° North Latitude⁷ to Arequipa, Peru, and Cuesta de Cillutincara in Bolivia⁷ (18°? South Lat.), not east of the Andes. I have not located this place in Bolivia.

Altitudinal Range.—In Colombia 800-3500 m. (2624-11483 ft.), in Venezuela 1800-4000 m. (5900-13000 ft.)¹⁸, in Ecuador 750-3300 m. (2460-10827 ft.) in Peru 300-2900 m. (984-9514 ft.), in Bolivia at 3000-3280 m. (9843-10760 ft.). These altitudes fall chiefly in the Subtropical zone of Chapman (1926 as reprinted by Brown 1941 †) and in the Interandine Subtropical Region of Acosta Solis (1944 ‡).

Seasonal Range.—January to October at Baños, 1800 m., also in December at a higher altitude (2500 m.). "The Andes of Colombia and Ecuador have heavy rainfall . . . on the Andes for some distance north and south of the Equator, there is really one long rainy season, with two maxima of specially heavy rain, April and November" Kendrew 1930. § The data given by Hershkovitz for Northern Colombia (1947 ¶) agree for Ecuador. The fewer localities known

* This is not the Vitor in the province of Arequipa at about 16° 40' South Latitude, shown on the maps. The handwriting on the envelopes of these two specimens is Dr. Kennedy's and is clearly Vitoc.

† Ann. Ent. Soc. Amer. 34 (4) p. 810.

‡ Flora, Quito, 4 (11-12) pp. 140, 199-204.

§ Climates of the Continents, Second Edition, Impression of 1930, Oxford, Clarendon Press, pp. 312, 342.

¶ Hershkovitz, P., 1947, Proc. U. S. Nat. Mus. 97 (3208): 1-46.

for Colombia lie within the Temperate zone of de Schaunsee (1948*); those in Peru in the Quechua, Yunga Fluvial and Rupa-rupa (or High Forest) Regions of Pulgar Vidal (1941 †). *Ae. marchali* occurs in the Northeastern, Central and Central Eastern Zoogeographical Provinces of Eigenmann and Allen (1942 ‡).

The Cuicocha male has the face yellow, pale green on the sides; line on the fronto-clypeal suture dark brown (S. Vicente), or brown (Celendin), more marked at each end than at the middle (Arequipa); stem of T-spot of frons of subuniform width or tapering cephalad, bordered each side by yellow or pale green whose width is variable but throughout usually narrower than the stem, wider in one male from La Pica and in some from Celendin; males from La Pica have the anterior end of the bordering yellow acute, which gives them a peculiar appearance; they have the characteristic long, complete, pale mesepimeral stripe of *marchali*. The bordering yellow is followed laterad with purplish brown (Arequipa) or pale blue (Colombia, Ecuador, Peru) extending beyond the level of the more often rounded end of the top of the T. Labrum pale green to cream inferiorly or cream throughout. Labium pale luteous to pale reddish or rosaceous, or approaching purple lake of Smith's Glossary, pl. IV, no. 10, with a pale green spot (in some indistinct) on each palp (lateral lobe). Rear of eyes black to vandyke brown.

Pterothorax pale brown with numerous pale brown hairs. Antehumeral stripe yellow, on the lower half or less of the mesepisternum, 1.23-1.80 mm. long, .41-.82 mm. wide above, narrowing and diverging downward (forward) from its fellow of the opposite side, divergence strongly marked (La Pica), farther from the middorsal carina than its own width and more remote from the humeral suture. The two lateral thoracic stripes yellow or pale blue, both sinuous; mesepimeral widest below, narrowing upward and reaching the upper margin of its sclerite, where it may widen again; at slightly above mid-height the anterior margin is concave, the posterior margin convex; in some males from Quito the pale mesepimeral stripe is interrupted slightly below its upper end, leaving a small pale spot at the upper margin of the sclerite (fig. 352, pl. XXVI); some further description of the mesepimeral stripe of this male is given in the Explanation of Plate XXVI under fig. 352; a small (.38 mm.) triangular yellow spot exists below the yellow mesepimeral stripe in the Arequipa males and in some from La Pica; metepimeral stripe straighter in its lower half, anterior margin more concave in the upper half, upper end bent more forward at the upper margin of the sclerite.

* Caldasia, Bogota, 5 (22) pp. 263-265.

† Bol. Mus. Hist. Nat. "Javier Prado" 5 (2) pp. 150-152.

‡ Fishes of Western South America, University of Kentucky, Lexington, Ky., pp. 40-41.

Abdominal pale spots: anterior dorsal (AD) on 3-7, larger on 3 than on following segments, very small on 4-7 (S. Vicente, Celendin) or absent (Cuicocha); median dorsal (MD) on 3-8 or -9; post-median dorsal (PMD) on 3-7, largest on 6 and 7 where it is incompletely separated from PD by two transverse black marks near (.16 mm.) together, in some the anterior mark a little longer than the posterior; on 3-4 or -5 (Arequipa, S. Vicente) PMD and PD are more completely separated by the fusion of the two transverse black marks and these marks being surrounded by reddish brown; PMD is not as blue as AD, PD, AL, ML, or PL, but has some admixture of reddish brown; it is always larger than MD and about equal in length, along the middorsal carina, to PD; PMD is confluent with MD on 3 or 4; it is not shown in our figs. 344 and 345 as these had been drawn from partly faded individuals; posterior dorsal (PD) on 3-10, more widely separated from its fellow of the opposite side on 8 and 9; anterior lateral (AL) on 3-8, confluent with AD on 3 and in some on 4-5 and 7; median lateral (ML) on 3-8, increasing in size from 3 to 6 or 7, usually not confluent with any other pale spots but in some with MD or PMD on 4 or 5; posterior lateral (PL) on 3-9, in some confluent with PD on 3 or 4. Ventral inflexed surfaces of the terga of 3-9 pale burnt sienna with or without indistinct dark marks. Sternites black, that of 8 with more pale hair (Colombia, Ecuador, Peru).

Auricles of segment 2 pale blue or yellow, with a lateral dark brown to black stripe, with two (three in one male from Colombia) teeth on the hind margin. Anterior lamina cleft to base, cleft pale clay yellow to blackish, lamina on each side of cleft black, often a pale streak mesad of each spine, spines black, nearly straight, reaching caudad to the level of half-length, or of entire length, of the hamular fold; in a male from La Pica (no. 69) the spines in profile view project beyond the ventral margin of the genital fossa, in ventral view the spines reach caudad not quite to the level of the hind edge of the hamular process. The acute anterior end of the sheath of the penis in front of, or behind, the level of the hind end of the fore lobe of the genital fossa, its rounded hind end at the level of the hind end, or of the mid-length, of the middle lobe. Genital lobe with 13-27 denticles in 2-3 longitudinal rows, the area occupied by them not widening anteriorly.

The penes of two males from Quito, one male from Patate, one male from Guasuntos and one male from Uyambicho, all Ecuador, were compared for structure. They seem to agree except as to the degree of swelling of the fourth segment (glans). This is least in the Guasuntos male, figs. 358, 359, pl. XXVI, which has the penis generally paler, and greatest in Quito male no. 302, which has the penis very dark. The difference in degree of swelling may be due to little or greater amount of contained sperm at the time of death. The following description is based on the penis of the Uyambicho male: 1st segment ventral margin not fully exposed, anterior limb straight, .42 mm. long; 2nd segment maximum length 1. mm., proximal end a little thicker than the distal, constriction a little proximal to mid-length; 3rd segment maximum

length .94 mm., proximal end .28 mm. thick, distal end .19 mm. thick; 4th segment maximum length, excluding the median ventral proximal lobe, .90 mm., with a thin, triangular, proximal lobe each side and a longer, median ventral proximal lobe, .24 mm. long, knobbed at its tip, not hooked; in ventral view, fig. 358, the fourth segment is quadrangular, the transverse proximal margin .76 mm., lateral angles rounded, lateral margins subparallel for .19 mm. thence converging slightly to an irregular apex .57 mm. wide, with a slight median notch, total length of each lateral margin .87 mm., dorsal surface for its entire length with a deep median longitudinal groove, each side of which is much swollen longitudinally.

Tenth abd. seg. with a basal middorsal longitudinal carina and two smaller parallel carinae on each side thereof; in profile the median carina is produced upward into a small tubercle projecting upward.

Superior appendages subequal to, or a little longer, or a little shorter, than abd. segs. 9 + 10, much as described for *californica*, maximum width .90-1.06 mm. at .375-.54 of appendage length. There are variations in the degree of hairiness not shown in our figures and in details of shape, figs. 339-342, 349-351, pl. XXVI. Viewed in profile the proximal two-thirds are horizontal, the distal third curved upward, a distinct subbasal inferior tooth, the posterior termination of an inferior longitudinal carina, at .16-.21 of the appendage length (somewhat variable in shape in males from Quito), which is followed by a concavity to $\frac{2}{5}$ length, remainder of the lower margin convex almost to the apex.

Inferior appendage reaching to very little more than half-length of the superiors, in profile view concave above, convex below throughout its length, apex with two slight, upturned denticles; in ventral view triangular, apex .16-.2 as wide as base.

Wings clear, faintly yellowish at extreme base or not yellowish (La Pica, Matucana, Arequipa) or faintly smoky (Latacunga, Celendin); costa yellow to beyond the stigma, other veins mostly brown; stigma cadmium yellow or pale brown ochre or indian red above, pale cadmium yellow below, surmounting more than one to three cells; membranule grayish brown to black, basal .10-.35 white.

♀. Differs from the male as follows: Face lilaceous (La Pica no. 72); antehumeral stripe .94-1.23 mm. long, .37-.5 mm. wide; blue abdominal markings replaced by luteous or greenish blue, PMD longer along the middorsal carina than PD on 3-7 (La Pica no. 72, Runtun no. 30), PL confluent with PD on 3-9 or on 3, 4, 6-8; abd. seg. 10 with a low, long, middorsal carina, hind margin with a transverse row of spinules. Genital valves reaching to or beyond the level of the hind end of the inflexed tergum of 9, lateral genital plates half as long as that tergum. Appendages longer than abd. segs. 9 + 10, similar to those of *californica*, but the apex obtusely rounded, maximum width 1.10-1.41 mm. at .58-.64 of appendage length, a submedian, dorsal, longitudinal carina.

Dimensions.—Abdomen (excl. apps.) ♂ 37-43 mm., ♀ 36-41, sup. apps. ♂ 4.00-4.74, ♀ 4.75-4.91, hind wing ♂ 36-41, ♀ 36-44, pterostigma, front wing, costal edge ♂ 2.04-2.70, ♀ 2.41-2.78 mm. Front wings with 13-15 antenodals, 7-12 postnodals, hind wings with 9-10 antenodals, postnodals 9-13.

The range in size of 11 ♂, 4 ♀ from Runtun, Baños, Ecuador, 2200 m. altitude, July, 1938 to June 6, 1939, is abd. (excl. apps.) ♂ 38-41, ♀ 36-41, hind wing ♂ 38-40, ♀ 36-40; of 28 ♂, 1 ♀ from San Vicente, Baños, Ecuador, ca. 1700 m., April to August, 1939, is abd. (excl. apps.) ♂ 38-41, ♀ 38, hind wing ♂ 37-40, ♀ 40 mm.

The range in size of 24 ♂, 9 ♀ from Celendin, Dept. Cajamarca, Andes, Peru, alt. 2625 m., May 25 to July 6, 1936, is abdomen (excl. apps.) ♂ 36-41 mm., ♀ 36-41, hind wing ♂ 37-41, ♀ 38-42.

Living colors.—The following notes are by Mr. Felix Woytkowski, the collector: "Celendin, Peru, June 4, 1936. This specimen . . . has fine vivid deep white blue markings: 7 pairs of dots on top of abdomen [PD] then 1 pair of blue stains on both sides below [abd. seg 1] then a blue ring (stripe) [abd. seg. 2] and again 2 blue stains on both sides below [AL]; the 12 small blue (some are greenish) dots and triangle in the center formed by 3 dots [MD?] all on its upper part. Two characteristic oblique greenish stripes on both sides of protorax [lateral thoracic stripes]. Opalizing eyes predominantly brown with a ring at the back and below of shining green. The front of the head light yellow with a suspicion of green. On the brown slope of protorax towards the head are two tiny dots of canary yellow (antehumeral stripes)". ". . . vicinity of Celendin, June 9/36 Insects marked with a red stain on top corner of folder were dried in a hermetical tin containing carbid (used for lamps). Some have kept a clear pattern on the abdomen! What is your opinion?" [Note by P. P. C.: I find three specimens, 1 ♂, 2 ♀, all Celendin June 9/36 with an irregular red stain, 10-15 mm. diameter, at the top of the envelopes. These three have the abdominal colors well preserved but some others, without the red stain on the envelopes, have the colors even better preserved]. "Celendin 2625 m. 17/vi/36 these 3 specimens have been dried in a hermetical tin with carbid (for mining lamps). I think that not only the pattern, color but even the opalizing tints of eyes are better. What is your opinion? They got so dry that, before packing I had to leave them during the night without

folders in order that they receive some humidity." [Note by P. P. C.: This envelope of June 17 has no red stain; this male has the blue spots on abd. segs. 3-7 well preserved but not on 8-10.].

Ecology.—The envelope of female no. 72 from La Pica, Colombia, collector's name not given, has this loose slip within: "Feb. 16, 1917 Taken at 19,000 ft. near small marsh. Others seen like it, but *very shy*." The following notes are by Mr. Felix Woytkowski, the collector: vicinity of Celendin, May 28, 1936, Over ditch of water flying in the evening." "Celendin, June 4, 1936, This specimen attaching or mating with the corresponding insect." "Celendin, June 5/36 N. B. I have strolled several times along brooks and other waters to see whether there are dusk-flying Odonata. There are none!" Teneral ♀ "vicinity of Celendin, June 9/36 High up the hills over a marsh, alights upon shrub fringing a glade, in its usual perpendicular way." "Vicinity of Celendin June 9/36 High up the hills on a tiny marshy ground, sat about 2" from the ground upon grass in its customary perpendicular way." "Vicinity of Celendin July 6/38 over a brook on the plain taken flying. This species is not faithful to any stable habitat: 1) it prefers running brooks with water plants and sheltered by bush, but 2) it is as frequently met over stagnant ponds and stagnant ditches, it 3) frequents humid paths bordered with shrubs and 4) at last it reaches highest hills and there it lives on the outskirts of bush clumps and in ravines. It is a keen flier, during sun hours they chase one another, but [I have] never seen more than 3-4 at a time. When there is no sun it hides on the outskirts of shrub, where it alights upon vertical dry twigs usually 10-15" from the ground; flies usually at the height from 1-4 yards, over water much lower; 10-20" over the surface; in dry hills high up it is more flighty and often soars to some 20-30 yards high and flies off (away) incredible distances; long before dusk it goes to bed sitting close to the ground." "Vicinity of San Idelfonso, Peru, July 29/36. All Odonata taken on the 29th of July were taken around laguna (pond) Rumichaca \pm 5 km. east of San Idelfonso upon the puna (grassland) zone of the Andes some 3500-4000 m. a. s. level. Except these few Odonata only one specimen was seen during the whole trip from Celendin to Chachapoyas, that is during 10 days!!! So Odonata do not abound in these altitudes. I was quite amazed at this scarcity."

Prof. Campos writes ⁸ of this species (translated): It is the most abundant Aeschnid of the interandine tablelands (mesetas). It frequents humid lands and is seen flying around ponds, following the course of brooks and currents of water or cruising swiftly over cultivated fields, pastures, etc.

Dried excrement protruding from the anus of a La Pica male was gently crushed by rubbing it between two microscope slides and examined dry under Leitz comp. microscope ocs. 4, objs. 3. The following fragments were observed: two pieces of corneal layer of a compound eye diameter of one facet .0146 mm., many fragments with hairs attached, 5 pieces of a wing membrane with part of a vein running through each, 3 pieces of legs up to a maximum length of .1 mm., bearing hairs.

Discussion.—Ris in his comparative descriptions ⁷ of *marchali* and *peralta* stated for the former (translated): On the upper side of the frons, alongside of the longitudinal part of the very wide T-spot, sharply defined, pale yellow, approximately triangular spots and for *peralta* (l. c. p. 159): Longitudinal stem of the T-spot narrowed forward with straight sides from its wide base to about half width; cross-piece running out laterally from its wide middle into fine points; the longitudinal stem accompanied by straight, sharply defined pale yellow stripes which are as wide as its anterior narrowest end. In our key to species, antea pp. 11-12, we have distinguished *marchali* from *peralta* by another of Ris' characters: *marchali*, the anterior [lateral thoracic = mesepimeral] stripe . . . ends (superiorly) fairly exactly at the boundary of mesepimeron and metepisternum but where the suture is not visible; *peralta*, the same stripe runs in the direction of the dorsal end of the posterior lateral suture but from which it remains separated by about 2.5 mm. We give three figures (pl. XXXVI, figs. 352 Quito, 356 Quito, and 357 Sta. Fe de Bogota) of this stripe in *marchali* and three figures (pl. XXIX, figs. 386 Matucana, 387 Puno, and 388 Penco) of this stripe in *peralta*. Assuming this difference in the long, or complete, mesepimeral stripe of *marchali* and the short, or abbreviated, mesepimeral stripe of *peralta* to be the chief distinction between these two species, I find too much variation in the T-spot and its accompanying yellow stripes within both *marchali* (pl. XXVI, figs. 343 Quito, 346 Quito) and *peralta* (pl. XXVIII, figs. 379 Matucana,

380 Puno, 381 Puno, 382 Puno) to justify using them as specific differentials. In individuals referred to *marchali* by the pale mesepimeral stripe the variation in the T-spot includes also those with the T-spot similar to fig. 379 of *peralta*; other variations are mentioned in the description of *marchali* above and shown in Table 1.

The distinction drawn in our key, antea pages 10, 11, couplet 7, 7a, between *marchali* et al. and *variegata* in the number of rows of cells between the fork of Rs under the stigma (3 in *marchali* et al., 4 in *variegata*) is subject to the following variation in 27 ♂, 11 ♀ of *marchali* from Celendin to Chachapoyas, Peru: 4 rows 2% front wings, 2% hind wings; 2 rows 1.3% front wings, 3.9% hind wings; 3 rows 96.1% front wings, 93.6% hind wings. A feature common to *marchali* and some other species of *Hesperaeschna*, viz., that the anal loop of the hind wings has 3 vertical rows of cells, is subject to the following variation in *marchali* when a larger number of individuals is tabulated than for our Table 15: 57 ♂, 3 rows throughout 95%, 4 cells at the bottom only 1.75%, 2 cells at the top only .87%, 2 rows, but 3 cells at the bottom 2.63%. A male from Ecuador, no further locality, has the anal triangle of the left hind wing 4-celled by splitting of the vein which normally divides the two basal cells from each other at about its mid-length into two veins, the fork so formed extending proximad to the base of the triangle, thus giving three basal cells instead of the normal two.

Prof. Walker* has distinguished between homoeochromatic and heterochromatic females of North American Aeshnas, those colored respectively like, or unlike, the males of their species; he remarks that these two color phases are not sharply marked off from each other but are connected by intermediate forms. I have attempted to distinguish these two color phases in the females of *marchali* but the presence of intermediates has prevented me from doing so.

Ae. (H.) peralta Tables 1, 3, 5, 6, 10, 12, 15; Pls. XXVIII, XXIX; Map 3. 1918. *Aeschna peralta* Ris, Arch. Naturgesch. 82 A 9: 160, fig. 105 (apps. ♂), Taf. II, fig. 106 (venation), p. 159 (key to allied spp.). 1952. *Hesperaeschna peralta* Calvert, Ent. News 63 (10): 254.

* North American Dragonflies of the Genus Aeshna, University of Toronto Library 1912, p. 29.

This species was described from Apurimac, Peru, and La Paz, Bolivia. The type was not specified; as the La Paz male is described first and is figured, it is hereby considered the type.

Material studied.—ECUADOR: Balsapampa, 10.v.38, 1 ♂, no collector's name, perhaps MacIntyre, coll. Kennedy. PERU: Mutucana, 5/25 & 27/20, J. H. Williamson 2 ♂ UM; Cuzco, 11500 ft., 7 & 10 July, 1911, Yale Peruv. Exped., 3 ♂ USNM; Marcapata, Staudinger vd., 1 ♂, 2 ♀, coll. Cowley; Puno, Nov. 1 & 3/98, 11 ♂, 9 ♀, Wm. J. Gerhart, ANSP, 3800 m., via Staudinger 1928, 1 pair in cop., also 1 ♂, 1 ♀, coll. Schmidt, "marchali det. Schmidt" 1 ♂, coll. Geijskes, 2 ♂, 2 ♀, coll. Cowley; Titicacasee via Staudinger 1928 1 ♂ coll. Schmidt, Vitoc,* Prov. Tarma, Dept. Junin, 5, 8 & 17 Abril, 1940, Woytk[owski] 1 ♂, 2 ♀ coll. Kennedy. CHILE: Camino a Farallones ± 1200 m., 5.xii.48, 1 ♂, 1 ♀, coll. Lieftinck; H. Las Mercedes Faz, 12.II.28 1 ♂, II.X.28, 1 ♂ coll. F. Ruiz, coll. E. Schmidt; Valparaíso, I.1936, coll. F. E. Reed ex Mus. Dahlem, 1 ♂ coll. Lieftinck; prov. Valparaíso, coll. A. Faz 1 ♂ coll. Needham; Villa Alemana, prov. Valparaíso, probably 1921-22, René Martin, coll. P.P.C. 1 ♀; Santiago, Quinta Normal, 24 Oct. 1941, R. Cortes 1 ♀ coll. Kennedy; Santiago, prov. Malvilla, 2.I.48, 3 ♂, and El Manzanito, Cordillera de Santiago, 1200 m., 24.X.1948, 1 ♂, Sergio Barras Valenzuela collector, in coll. Lieftinck: Banos de Cauquenes, C. E. Reed, 1 ♂ 2 ♀, USNM; Penco, I.05, 1 ♂ ANSP; Puente or Punta, Beatina or Teatina (spelling uncertain), Serena, Javar, 13.4.42 1 ♂, 27.11.42 1 ♀ and Angol, 27.1.42 1 ♂ D. S. Bullock coll. Needham. ARGENTINA: Nahuel Huapi, II. 48, Breyer 1 ♂, and El Infernillo, 3000 m., 10.XII.47, Golbach, 1 ♂, coll. Mus. Univ Tucumán. BRAZIL: Sudhang Itatiaya Gebirg, 700 m., Rio de Janeiro, 9.I.1927, Zikan 1 ♂ coll. E. Schmidt. Total 41 ♂, 23 ♀.

Distribution.—Balzabamba, Ecuador, 1° 45' South Latitude (one individual) to the province of Malleco 37° South in Chile, La Paz in Bolivia, Lago Nahuel Huapi (41° South) and El Infernillo in Argentina and the State of Rio de Janeiro in Brazil 23° South.

Altitudinal Range.—At 630 m. (2067 ft.) in Ecuador, 2350-3800 m. (7610-12570 ft.) in Peru, at 3750 m. (12307 ft.) in Bolivia, 72-1200 m. 236-3937 ft.) in Chile, 740-3000 m. (2427-9842 ft.) in Argentina, at 700 m. (2296 ft.) in Brazil. Matucana, Peru, lies in the Maritime Yunga region of Pulgar Vidal (1941), Cuzco and Puno in his Suni region.

Seasonal Range.—In Peru April, May, July and November; in Chile October, December to February, April and May. On the coasts

* For Vitoc see page 60, footnote *.

the wettest months are August in Peru, June and July in Chile, the driest is January or February in Peru and Chile. On the *plateau* the wettest month is April in Ecuador, February in Peru, January or February in Bolivia, the driest is July in Ecuador and Peru, June or July in Bolivia.* Cuzco and Valparaiso individuals of *peralta* were taken in the dry season at their respective localities, the other dated specimens of our material were collected between seasons.

♂. Face lilaceous in some, a black line on the fronto-nasal suture. T-spot of the frons black or dark roman sepia (Smith's Glossary), stem bordered on each side by a yellow stripe which is narrower than the stem, or may be wider at its anterior end than the stem; the bordering yellow followed laterad by bluish (dull in some) which reaches laterad to beyond the level of the, often acute, end of the top of the T. Labrum lilaceous in some, inferiorly paler. Labium: mentum (middle lobe) and palps (lateral lobes) pale bluish or lilaceous, base yellow. Occiput pale yellow, its posterior margin barely convex or straight, black at each end. Rear of eyes black or brown, black along the eye-margins.

Pterothorax near olive green, with pale brown hairs, humeral and second lateral sutures each with a black line. Pale antehumeral stripe very small, .57-1.47 mm. long, confined to the lower (anterior) half of the mesepisternum, .16-.41 mm. wide, a little nearer to the mid-dorsal thoracic carina than to the humeral suture, diverging downward (cephalad) from its fellow of the opposite side. In the 3 ♂ from Santiago, 1 ♂ from Valparaiso, 1 ♂ from El Manzanito, 1 ♂ from Camino a Farallones and 1 ♂ from Penco, all Chile and therefore not topo-typical, I found no trace of a pale antehumeral stripe; these seven therefore resemble *variegata* (Fabr.) Ris in this respect but only one of the seven has the denser venation characteristic of *variegata* and that in only two (right front, left hind) of its four wings. In the ♀ from Camino a Farallones, the 3 ♂ from Cuzco and the ♂ from Baños de Cauquenes the pale antehumeral stripe is visible. The pale antehumeral is not visible (faded?) in 1 ♀ from Puno and 2 ♂ from Las Mercedes, Chile; it is visible in 2 ♂, 1 ♀ from Puno, the ♂ from Titicacasee and the ♂ from Itatiaya; all these 6 ♂, 2 ♀ have not more than three rows of cells in the fork of Rs under the stigma.

Sides of the pterothorax with two oblique yellow or bluish (Matucana) stripes, a little sinuous, not margined with black, the anterior (mesepimeral) reaching upward to .70-.79 of the height of its sclerite, of subuniform width (.33 mm.); posterior (metepimeral) stripe wider (.8 mm.), reaching to the hind margin of its sclerite.

* Kendrew, *Climates of the Continents*, Second Edition, Impression of 1930, Oxford, Clarendon Press, pp. 312-322, 342. Reed, *Climate and Man Yearbook of Agriculture*, U. S. Dept. Agric., 1941, pp. 674, 675.

Abdominal segment 1 pale brown, a yellow or blue lateral spot on its posterior half; 2 pale brown dorsally, most of the segment in front of the transverse accessory carina yellow or blue, including the auricle except for its black lateral margin, and a transverse stripe running dorsad close to the carina; lower half or more of the segment behind the carina yellow or blue except for a dark brown or black longitudinal stripe at the level of the auricle. Segments 3-10 predominantly pale brown ochre (near Smith, Glossary, pl. IV, fig. 36 but paler), including the spots AD, MD, PMD, PD, AL, ML, and PL and the ventral inflexed surfaces of the terga; PD more widely separated by the middorsal black on 8 and 9 than on 3-7 or 10; dorsal spots PMD and PD and lateral spots AL, ML, PL blue in some Matucana and Cuzco males, PMD confluent with PD on 4- or 5- or 6-7 or only on 7; PMD confluent with MD on 3- or 5-7, when not confluent the two black spots between them may be separate, or fused on 3 and 4; AL and AD confluent on 3-5 or only very narrowly so on 4 and 5; ML confluent with MD on 3, narrowly so on 4, or narrowly so on 6 and 7, or ML not confluent with any other spot on 3-8; PD and PL confluent on one or more of segments 3-9.

Auricles of 2 each with two teeth. Cleft of the anterior lamina .28-.41 mm. wide at its hind end, lamina mostly pale yellow or pale brown ochre, but the margins of the cleft brown or black; apices of the spines reaching caudad to the level of the hind end of the hamular process or beyond. Hamular processes of a paler reddish brown than, or the same color as, the lamina, their mesal margins .25-.45 mm. long, acute anteriorly, posteriorly divergent. Hamular fold rather acutely rounded at hind end. The very acute anterior end of the sheath of the penis a little in front of, or a little behind, or at, the level of the hind margin of the front lobe of the genital fossa, its truncated or rounded posterior end at, or a little behind, the level of the hind end of the middle lobe, almost to the level of the genital lobe. The dried penes of males from Matucana and Puno, Peru, and Penco, Chile, are shown in our figures 393-395, 398-400, pl. XXIX. While their structure is in general like that of *marchali* differences in detail are evident; whether these differences have geographical significance has not been investigated. Genital lobe with 15-35 black spinules whose occupied area, in ventral view, widens markedly cephalad.

Abdominal segment 10 in its anterior half with a middorsal longitudinal carina whose posterior end descends abruptly, two smaller and lower carinae on each side of it. Superior appendages equal to, or slightly longer than segments 9 + 10, in dorsal view nearly straight, widening on the mesal side in the basal half, thence narrowing gradually in the apical half to apex, which is obtusely rounded or truncated, maximum width .76-.94 mm. at .43-.55 of appendage length; in profile view slightly concave superiorly, slightly convex inferiorly throughout its length, the superior longitudinal carina elevated in the terminal .3 of the appendage length and not denticulated; an inferior tooth at about 1/5 the appendage length, this tooth being the hind end of a longitudinal ventral carina, posterior edge of tooth steeper than anterior edge.

Inferior appendage reaching to a little more than half-length of the superiors, in profile view concave superiorly, convex inferiorly throughout its length; in ventral view its apex roundly truncated .19-.29 as wide as width at base.

Wings clear, faintly yellowish at extreme base, costa to beyond stigma yellow, Sc and R less so, other veins brownish, in some the cross-veins between C and R, base to nodus, are yellow. Stigma surmounting more than two but less than three cells, cadmium yellow (Smith, pl. IV, fig. 20) above and below, or pale brown, or brown ochre, or vandyke brown above, cadmium yellow below, with a brownish streak occupying the middle $\frac{2}{4}$ of its width for its entire length, or without such a streak, or brown ochre below. Membranule: more than the basal half white, remainder greyish brown.

♀. Differs from the male as follows: Abdominal segment 10 with a black middorsal longitudinal carina, sternum with about 80 fine black spinules, not regularly or bilaterally symmetrically arranged. Ovipositor reaching caudad to or beyond the level of the hind end of the inflexed tergum of 9, genital valves reaching to, or not as far as, that level, lateral genital plates reaching to $\frac{1}{3}$ to $\frac{1}{2}$ of that level; basal genital plate bilobed, distal margins of the lobes in the same transverse straight line, or slightly convex. Anal appendages subequal to, or longer than, abdominal segments 9 + 10, maximum width .65-.82 mm., at .47-.62 of appendage length, lateral margin almost straight, mesal margin convex apex obtusely rounded or acute. Stigma chrome lemon (Smith, Glossary, pl. IV, fig. 17) in a Puno female.

Dimensions.—Total length ♂ 52-62 mm., ♀ 52-61 mm. Front wings, both sexes, 12-15 antenodals, 7-10 postnodals; hind wings, both sexes, 8-11 antenodals, 8-12 postnodals.

Puno, Peru: 5 ♂, 7 ♀, abdomen (excl. apps.) ♂ 35-39 mm., ♀ 34-38, sup. apps. ♂ 4.00-4.25, ♀ 3.27-4.17, hind wing ♂ 35-38, ♀ 35-39, stigma, front wing, costal edge ♂ 2.21-2.45, ♀ 2.41-3.03 mm.

Chile, 4 localities: 5 ♂, 4 ♀, abd. (excl. apps.) ♂ 36-41, ♀ 40-42, sup. apps. ♂ 4.34-5.00, ♀ 3.68-4.09, hind wing ♂ 38-40, ♀ 40-41, stigma, front wing, costal edge ♂ 2.29-2.62, ♀ 3.03-3.44 mm.

Discussion.—In the preceding article on *marchali*, differences between it and *peralta* have been considered. Ris's original description of 1918 is the only mention of *peralta* that I have found in the literature. In it "Occiput" and "Occipitaldreieck" are what are here called "Rear of the eyes" and "Occiput" respectively. (See Snodgrass 1935, Principles of Insect Morphology p. 106, fig. 56C, pp. 112, 128, on the usage of these terms). What we have here called the post-median spot, PMD, of abdominal segments is mentioned by Ris as "zwischen MD und PD ein grosser nicht konfluierender Fleck" and as "der supplementäre Fleck".

Two males, one of them from Serena, Chile, 13.4.42, have the anal triangle 4-celled instead of 3-celled; in the Serena male, on the right hind wing, the longitudinal vein separating the two normal proximal cells is fused near its mid length with the lateral side of the triangle, thus forming two small triangular cells between itself and the lateral side of the triangle; the proximal of these two small cells is longer than the distal of these two small cells. The other male, whose provenance has not been noted, unfortunately, has the anal triangle of the left hind wing 4-celled by the normal distal cell being divided into two cells by a cross-vein so placed that the proximal cell is .65 mm. long, the distal 3.03 mm. long.

Ae. (H.) biliosa

Tables 1, 3, 5, 7, 10, 13, 15; pl. II; Map 1.

1939. *Aeshna biliosa* Kennedy, Ann. Ent. Soc. Amer. xxxi (4) p. 573, pl. i, figs. 1-7 (♂ and details);¹ xxxii (2) p. 344, figs. 1-5 (♀ and details).²

Material studied.—ECUADOR: Baños, 1900 m., 14.5.39, 1 ♂, 14.9.37, 1 ♂ 2000 m., 15.7.39, 1 ♀, 20.7.36, 1 ♂, El Tablon near Baños, 2000 m., 28.10.38, 1 ♀ Kennedy's allotype, Runtun Lake, Baños, 2200 m., 6.6.39, 1 ♂, 14.8.39, 1 ♂, Panticuchy near Baños, 2500 m., 2.10.37, 1 teneral ♂, La Ventana, Rio Pastaza watershed, 2000 m., 5.36, 1 ♂ Kennedy's holotype, Mt. Tungurahua, 3500 m., 5.1.38, 2 ♂, Champi (correctly Chaupe) on Mt. Tungurahua, 2600 m., 28.6.39, 1 ♂, all taken by William Clarke MacIntyre in coll. Kennedy (1 ♂ given to P.P.C.). PERU: "Taken flying vicinity of Almirante, Dept. Amazonas. Really taken 10 km. west of Almirante in 'Bogasan' some 2400 m. a. s. level 23.12.36. Unique specimen seen in that region most carefully explored. Collector Felix Woytkowski," 1 ♂ UM. Total 11 ♂, 1 ♀.

In addition to the holotype and allotype, the males collected in 1936-1938 were paratypes of Kennedy.

Distribution.—Ecuador and northern Peru, in the Andes, 1°-7° South Latitude.

Altitudinal Range.—1900-3500 m. Subtropical faunal zone of Chapman * for birds and Interandine Subtropical Natural Region of Acosta Solis † for Ecuador, Fluvial Yunga region of Pulgar Vidal ‡

* Reprinted by Brown, Ann. Ent. Soc. Amer. 34 (4), p. 810.

† Flora, Quito, 4 (11-12), pp. 140, 199-204.

‡ Bol. Mus. Hist. Nat. 5 (2), pp. 150-152.

and Northeastern zoogeographical province of Eigenmann and Allen * for Peru.

Seasonal Range.—May 1–October 28 and January 5 in Ecuador, December 23 for one capture in Peru. These months lie between two maxima of rain, April and November, according to Kendrew.**

♂. Face and upper surface of frons bright chrome yellow (Smith's Glossary, pl. IV, no. 17), or with a faint tinge of blue giving a pale green effect (holotype), or pale cadmium yellow (Chaupe), or pale dull yellow (teneral from Panticuchy); a pale brown line on the fronto-clypeal suture (absent in Panticuchy teneral). Labrum tending to orange, a black line at its articulation with the clypeus, distal margin narrowly edged with brown. Black T-spot of the frons with the stem parallel-sided, each arm of the top as long as half the width of the stem or shorter (Bogasan) and ending on a level with the lateral ocellus of the same side or less remote; no blue or green on the upper surface of the frons, or a faint trace beginning at the level of the antennae. Mandibles black. Labium reddish brown (near dragons blood to burnt sienna of Smith's Glossary) or paler. Vertex blackish in most, or with two small yellowish or greenish spots (Baños). Occiput .65–1.06 mm. long, yellowish above, all edges blackish or brown; rear of head (postgenae) black. Eyes in contact for 1.23–2.04 mm.

Prothorax blackish brown, front margin, a transverse stripe on the middle lobe, lateral angles and adjoining part of posterior margin pale green, hind lobe with its hind margin trilobed, the median lobe thereof convex and strongly produced dorsad beyond the lateral lobe of either side; propleura pale reddish brown.

Pterothorax dark reddish brown (from near indian red to burnt sienna of Smith's Glossary), paler below, with yellow spots as follows: two each on the mesonotum and the metanotum, the anterior larger, between the wing-bases (or the second mesonotal and the metanotal blue), three on the dorsal surface of each wing-base, one or two in the antealar sinus, two on the mesepisternum, the upper much the smaller (fig. 21, pl. II), three on the mesepimeron, one on the upper end of the metepisternum very close to the uppermost mesepimeral spot, two on the metepimeron, of which the upper is much the larger and U-shaped, its arm directed cephalad and dorsad, and one opposite the front margin and one opposite the hind margin of the hind wing. The last-named spot

* Fishes of Western South America, University of Kentucky, Lexington, Ky., pp. 40–41.

** Climates of the Continents, Second Edition, Impression of 1930, Oxford, Clarendon Press, p. 342; Fourth Edition, 1953, pp. 485–487, 525.

and the notal spots are not shown in our figure 21. A pale greenish or yellowish mid-ventral stripe (absent in some) from between the bases of the third legs, widening caudad and stopping at the unpaired sclerite which bounds the metasternum posteriorly.

Legs: coxae, trochanters and most of femora reddish (pale clay yellow, teneral from Panticuchy); some marks on the trochanters, distal half to fourth of all femora, first femora inferiorly, all tibiae and tarsi black (pale brown teneral male from Panticuchy); a carina running along the bases of the lateral spines of the tibiae.

Abdominal segments 1 and 2 mostly reddish brown or vandyke brown, 3-10 blackish brown, becoming blacker caudad, paler, reddish brown, below, on the inflexed terga. Antero-dorsal spots AD represented in some by a narrow mid-dorsal greenish or yellowish stripe on 2, a median pale dot on 3-7; middorsal spots MD blue on 2, yellow (teneral from Panticuchy, 1 Tungurahua) or green (Banos 1, Runtun lake 1) or faded(?) to brown ochre (Runtun lake 1, Chaupe) on 3-7, confluent with each other dorsally and with PD near the median line, but not on 3-6 or -7; MD confluent with ML on 3-6 or -7; postero-dorsals PD on 1-9 or 2-6 blue or yellow, confluent with each other dorsally on 1 and 2 and almost so on 3 but not on 4-9, decreasing in size from 2 to 7, forming a narrow transverse stripe on 7, on 8 and 9 longer antero-posteriorly but not as wide transversely and more lateral in position. Antero-lateral spots AL on 2-7 or -9 green, yellow or faded(?) to brown ochre, on 2 with a dorsal prolongation bordering the transverse median carina anteriorly but not always reaching the middorsal line or pale stripe; confluent, or nearly so, with ML on 3-5 or -8, decreasing in size from 3 to 8, bifid dorsally on 4- or 5-6 or -7. Midlateral spots ML green or blue on 1 (?) or 2-8, confluent with PL. Postlaterals PL green or blue or brown ochre on 1 and 2 and as dots on 4 and 5, elongated on 6 or 7-9; there is also a small blue spot on 2 in a depression dorsal to the genital lobe (pl. II, fig. 19). No pale spots on 10 except in the teneral male from Panticuchy in which 10 is apparently chiefly blue except for a middorsal black stripe. In one male from Mt. Tungurahua, the posterior half of the dorsum of 1, in profile view, is occupied by a transverse rounded ridge whose height is subequal to its base; 2 is strongly and angularly elevated dorsally at the transverse median carina; on each side of the dorsum, at about halfway from the carina to the hind margin of the segment, is a short elongated swelling which runs obliquely dorsad and caudad.

Abdominal segment 2 with 2-3-toothed auricles. Spines on the anterior lamina reaching caudad to the level of the hind edge of the hamular processes; anterior and posterior hamules, sheath of the penis, penis and spinulose genital lobe as shown in pl. II, figs. 17 and 22; the area occupied by the spinules on the genital lobe widening cephalad, but the stoutest spinules are in the hind part of the area. If the yellow to orange-colored parameres of *biliosa* offer as much contrast in life to the surrounding reddish brown as they do in the dried

dead condition, they may serve possibly as a species guide, or species recognition mark, to the female, as the pale blue of the ventral surfaces of segments 9 and 10 of males of *cornigera*, *psilus* and other species may do for their females. Segment 10 with anterior middorsal carina, smaller elevations on each side thereof and anal appendages as shown in pl. II, figs. 12, 13.

Wings uncolored to smoky yellow or smoky brown, stigma above brown ochre or blackish brown, in some with pale margins inside the bounding veins, below pale cadmium yellow, pale clay yellow both above and below in the teneral male from Panticuchy. Membranule pale ash gray at base, blackish from proximal end of anal triangle caudad (pale yellow turning to gray along the anal triangle, teneral male from Panticuchy).

♀. Differs from the male as follows: Face pale clay yellow and labrum tending to gamboge in the Baños female. Stem of the black T-spot wider at base than at apex. Labium nearer to brown and the vertex unspotted in the allotype, two ill-defined yellowish spots in the Baños female. Occiput .9 mm. long, eyes in contact for 1.88-2.3 mm.

Prothorax black, anterior and lateral margins pale yellowish, one (or a pair? of) small orange spots near the center of the middle lobe. Pterothorax not as dark a reddish brown, perhaps faded after death,* pale spots much faded, apparently similar to those of the male. More than the proximal half of the inferior surface of first femora reddish (allotype), red of femora of male replaced by yellow (Baños).

Pale spots of abdomen as described for the male but generally reddish or yellowish in the allotype, probably due to fading, PL on 1-7 or -8; in the Baños female 1 and 2 dorsally vandyke brown, 3-10 brown ochre, AD not evident, MD green or yellow on 3-6, confluent with ML, PD indistinct on 3, green on 4-7, AL yellow(?) or green on 2-8, bifid dorsally on 3-6, ML yellow or green on 3-8, confluent with PL on 2† and 8, PL on 2-5, 7 and 8. Transverse dorsal ridge on 1 and angular dorsal elevation on 2 present but less marked. A transverse elliptical, polished, dark brown area, bounded anteriorly by a transverse yellow carina, on each side of the sternum of 2 near its anterior margin, separated from each other by a distance subequal to the longer axis of each present in the allotype but not evident in the Baños female. Sternum of 10 with numerous spinules directed caudad. Ovipositor black at base, reddish distad (allotype) or pale brown ochre (Baños); in the allotype, at least the apices of the inner gonapophyses are pale yellow thereby offering a

*Prof. Kennedy says² page 346: "In the single allotype specimen the colors were badly injured by dipping the thorax into hot water to relax the wings . . ."

†Our interpretation of the pale spots on abd. seg. 2 differs slightly from that indicated by the labels on Prof. Kennedy's fig. 1 of the abdomen of *biliosa* 2. What he labels AML (anterior-median lateral spots), we regard as AL only because it lies anterior to the transverse median carina; what he marks PL (posterior lateral) we consider to be MPL. His labels of segment 3 agree with our interpretation of both segments 2 and 3.

strong contrast in color to the others. Genital valves dark reddish brown (allotype) or pale brown ochre (Baños). Lateral genital plates reaching caudad to the level of less than half the length of the inflexed tergum of 9. Basal genital plate bilobed, distal margins of the lobes in nearly the same straight transverse line, that of each lobe slightly concave (pl. II, fig. 14). Anal appendages longer than segments 9 + 10, shown in the same figure.

Wings smoky yellowish, especially near the costal margin; stigma chrome orange above, pale cadmium yellow below (allotype) or cadmium yellow both above and below (Baños). Membranule pale ash gray at base, remainder black (allotype) or brownish gray (Baños) from point of separation of anal vein and the vein bounding the proximal edge of hind wing.

Dimensions.—Abdomen (excl. apps.) ♂ 51-57, ♀ 55, sup. apps. ♂ 5.89-6.38, ♀ 7.36, hind wing ♂ 49-54, ♀ 55, pterostigma, front wing, costal margin ♂ 2.3-2.78, ♀ 3-11 mm. Front wings with 19-24 antenodals, 12-16 postnodals, hind wings with 12-15 antenodals, 15-20 postnodals.

Ae. (H.) joannisi

Tables 1, 3, 5, 7, 10, 13, 15; Pl. XXIII, figs. 297-307; Map 1.
1897. *Aeschna joannisi* Martin, Ann. Soc. Ent. France 1897, p. 592 ("une seule ♀ Bolivie").¹
1909. *Aeschna joannisi* Martin, Colls. Zool. Selys-Longchmp. fasc. XVIII, p. 56 (♀ description rewritten, coll. R. Martin, Bolivie).²

Material studied.—COLOMBIA: Popoyan, 11.8.12, 1 ♂, Cornell University from Prof. J. G. Needham. ECUADOR: Abitagua, 1100-1200 m., 5.11.39, with males of *cornigera planaltica*, probably by William Clarke MacIntyre, in coll. Kennedy, 1 ♂. Total 2 ♂.

Distribution.—Colombia 2° 40' North Latitude, to Bolivia, 18° South L.

Altitudinal Range.—2000-1200 m. (6562-4265 ft.). These altitudes fall in Colombia within the tropical zone of Chapman* and tropical and subtropical zones of de Schauensee† based on the avifauna; in Ecuador in the tropical and subtropical of Chapman,‡ in the tropical hot and interandine subtropical natural regions of Acosta Solis.§

Seasonal Range.—May in Colombia, November in Ecuador. April and November are the rainiest months at Bogota and at Quito; *joannisi* seems therefore to fly in both the dry and the wet seasons.

* 1917. Bull. Amer. Mus. Nat. Hist. 36: 85.

† 1948. Caldasia, Bogota 5 (22): 263-265.

‡ As reprinted by Brown 1941, Ann. Ent. Soc. Amer. 34 (4): 810.

§ 1944. Flora, Quito 4 (11-12): 140, 199-204.

♂. Face bluish green (yellow in the middle of the lower part of frons and on each side of lower part of anteclypeus (nasus) Abitagua), post clypeus blue, fronto-clypeal suture with a brown line. Sides of stem of black T-spot of frons converging cephalad (Popoyan) or parallel (Abitagua), bordered laterad by a yellow stripe narrower than the stem, this yellow followed laterad by greenish blue which reaches around the top of the T on to the anterior surface of the frons. Upper surface of frons with a black stripe at base embracing the bases of the antennae, celli and vertex; arms of the top of the T-spot reaching laterad to the level of the antenna of the same side or slightly beyond, and with a patch of brown hairs near their ends in the Abitagua male. Labrum tending to cream color, a black line on the clypea-labral suture, distal margin narrowly edged with black. Labium pinkish (Popoyan) or burnt sienna (Abitagua). Vertex rather closely set with brownish hairs (Abitagua). Occiput triangular, yellowish, wider than long, anter-posterior dimension .9 (Popoyan) or 1.06 mm. (Abitagua), hind margin slightly concave, its three angles black. Eyes in contact for 1.23 mm., rear of eyes black.

Prothorax (Popoyan): pronotum black, anterior division pale brown ochre, posterior division widest of the three, bilobed, with long (1.64 mm.), pale yellowish hairs on the hind margin, median division bilobed anteriorly; propleura and ventral surface pale brown ochre.

Pterothorax near dragons blood (Smith's Glossary pl. IV, no. 34), with many brownish and whitish hairs (fewer—rubbed off?—Popoyan), the following yellow: a small antero-posterior streak in the mesal end of each antealar sinus, an anterior and a posterior median mesonotal spot, a spot on the base of each front wing, one each below the base of the front edge and of the hind edge of the hind wing; none of these are shown in our fig. 306, pl. XXIII.

Mesepisternum with a stripe 1.30 (Popoyan)-1.40 mm. (Abitagua) long occupying less than the lower half of the sclerite and a spot .74 (Popoyan)-.5 mm. (Abitagua) just in front of the antealar sinus, both yellow, the stripe diverging cephalad from its fellow, separated both from the mid-dorsal carina and the humeral suture by more than its own width and pointed at its anterior end.

Mesepimeron with a sinuous yellow stripe as long as the sclerite, stripe with a wide sinus on its anterior margin in its upper half and a narrow sinus on its posterior margin in its lower half, maximum width between the two sinuses 1.72 (Popoyan), 2.00 mm. (Abitagua). Metepimeron with a sinuous yellow stripe as long as the sclerite similar to, but not identical with, the mesepimeral stripe and of the same width between the sinuses (pl. XXIII, fig. 306).

Abdominal segments 1 and 2 on dorsum largely indian red, a transverse green stripe on the sides and dorsum of 1, narrowing dorsad; sides of 2 for entire length of segment above and including auricle (except apex), and a confluent transverse stripe at the hind end, green (colors better preserved in the Abitagua male). Segments 3-5 reddish brown (Popoyan), 3-10 black (Abitagua).

tagua), AD absent, MD triangular, faded (?) to brown ochre on 3-8, not confluent dorsad with its fellow of the opposite side, confluent narrowly with ML on 3-7, but not on 8; PD pale green on 3-9, not confluent with its fellow of the opposite side nor with PL; AL faded (?) to brown ochre on 3-8, decreasing in size from 3 to 8, bifid dorsally on 4-7; ML on 3-8, confluent as above; PL yellow or brown ochre, indistinct on 3 or 4-7; 10 blackish with (Popoyan) or without (Abitagua) pale markings on each side of dorsum; 3-9 pale reddish brown on the ventrally inflexed terga, also the sternum of 10; parameres of 9 pale ochre.

In profile view abdominal segment 1 convex in its posterior dorsal half, 2 sharply angulated dorsally at the transverse median carina. Each auricle with 2 (Popoyan) or 3 distal teeth. Spines of anterior lamina reaching caudad beyond the level of the anterior angle of the hamular processes but not as far as the level of the hind edge of those processes. Contents of the genital fossa generally yellowish except for a small dark brown spot (not shown in our fig. 305, pl. XXIII) laterad to each spine of the anterior lamina and about half as long as the spine; other details shown in our figs. 299, 300, 305, the appendages in figs. 297, 298 of the same plate.

Wings uncolored except for faint yellowish at the base not extending beyond the first antenodal (Popoyan), or faintly smoky brown, many cross-veins in the anterior part of the wing margined with pale brown (Abitagua), venation brown, costa anteriorly brown ochre. Stigma cadmium yellow (Popoyan) or brown ochre (Abitagua) above, below cadmium yellow. Membranule pale ashy gray at base, brown- or blackish-gray from the level of the base of the anal triangle.

♀. Differs from the male according to Martin's translated descriptions of 1897 and 1908 and Dr. Erich Schmidt's notes in English and drawings made June 24, 1951, from type in the Musée Nationale d'Histoire Naturelle at Paris, at my request. Tail of the T-spot elongated between two elongated yellow points; the pale blue bordering the face ascends as far as these two points on each side of the tail of the T.¹ T-spot with tail extremely thick and with an enormous head not reaching beyond the summit of the frons except as a wide brown cloud.² Dr. Schmidt's drawing of the T-spot from Martin's female holotype is reproduced as our fig. 301, pl. XXIII.

Labrum: Both of Martin's descriptions^{1 2} give the labrum as black, a color not found on the labrum in any neotropical *Aeshna* examined by me. Dr. Schmidt's notes are: "In both specimens it is not black!! In No. 1 it is red brown, in the middle somewhat yellow but anterior border is narrowly dark brown, the base also is darkened. Condition in No. 2 is at least similar."

Thorax: Dr. Schmidt's drawing of the thoracic pattern of Martin's female No. 2 from San Antonio, our fig. 307, pl. XXIII, shows the pale lateral stripes wider than in the male, cf. fig. 306.

Abdominal appendages of the shape of willow leaves, longer than the last two segments.² "In *Ae. joannisi* the spinulose tubercle is present on abd. seg. 1!!"—Dr. Schmidt's note.

The 4 wings a little saffron, especially between the costa and the median . . . Vein of the nodus remarkably thick . . . 21 antecubitals, 15 postcubitals on the superiors¹ "Supratriong cross-veins $\frac{4.4}{3.3}$; anal loop 3.3 holotype; . . . specimen No. 2 (S. Antonio) has supratriong. cross-veins $\frac{4.3}{3.3}$; anal loop 3.3 vertical rows."—Dr. Schmidt's notes.

Dimensions.—For the males the first figures are those of the Popoyan male, the second of the Abitagua male; for the female the figures are those of Martin.¹ Total length ♂ 69 mm., 69, ♀ 66, abdomen ♂ (excl. apps.) 46, 46, ♀ (incl. apps.) 50, sup. apps. ♂ 4.91, 5.24, hind wing ♂ 41, 41, ♀ 48, pterostigma front wing, costal edge ♂ 2.13, 1.88. Front wings with 19-17 antenodals, 13-11, 13-12 postnodals, ♀ 21 antenodals, 15 postnodals. Hind wings with 11-12, 12 antenodals, 14, 13 postnodals.

Dr. Schmidt writes of Martin's types of *joannisi* as follows: "in same box 2 specimens, both females. No. 1 *A. joannisi* M. (app. brisé) Bolivie—No. 2 *A. joannisi* Martin, S. Antonio. As in *Ae. unicolor* no type is marked by Martin. The specimen No. 1 is not in good condition as the patterns described by Martin in 1897 and in Cat. Coll. Selys are not visible, besides the loss of appendices. But this specimen has as locality 'Bolivie' as is written by Martin 1897, and as Martin at that time had only "une seule femelle de Bolivie" we must suppose—it is a pity—that this No. 1 is the type." After his note on the labrum, quoted above, Dr. Schmidt continues: "My opinion is that the 'levre supérieure noire de Martin' is one of the numerous 'négligences' of this author and that he has not compared the specimen again when he wrote his second description. The female No. 2 from S. Antonio is in much better condition and I have made the drawing of patterns of thorax and abd. segm. 6 [our figures 307 and 304, pl. XXIII] from this specimen. My opinion was, that in this case it is better to characterize the species from a specimen that shows the characters than from the type which does not show them more. I believe also that the drawings given agree sufficiently with Martin's description. Besides this I believe that both specimens belong to same species as Martin believed also according to his labels. When writing this I have not the description in hand, but it is, as it seems to me, not even quite sure that Martin had made his description from specimen No. 1, but from No. 2, and if I should know a permitted way to make specimen 2 the type I should go this way. The locality San Antonio

occurs at least seven times in Bolivia, but also in other countries as I suppose; the patterns of abdomen are very characteristic in both species from Bolivia (unicolor and joannisi); see my drawings. The prolongation of the light yellow spot on dorsal side in No. 2 is conspicuous and also visible in No. 1 (type)."

The clue to my identification of *joannisi* is Martin's description¹ of the thorax (translated): thorax quite thick, pale bronze color, bearing below on each side a small yellow spot and quite above two other smaller yellow spots; above the interalar sinuses a row of four yellow spots and the sinuses themselves punctated with small yellow points. These spots and points of Martin are those of the mesepisternum and mesonotum of our description of the males.

Ae. (H.) punctata

- Tables 1, 3, 5, 7, 10, 13, 15; Pls. XXXII, XXXIII figs. 441-444; Map 1.
 1908. *Aeschna punctata* Martin, Colls. Zool. Selys-Longch. Cat. Syst. Descr. fasc. XVIII, pp. 54, 83 (key), fig. 51 (♂ apps.) ("types et coll. René Martin, Mexique, Bresil").¹
 1911. *Aeschna punctata* Martin, Gen. Insect. 115, p. 12, pl. II, figs. 4 (♂), 4a, 4b (apps. ♂).²
 1861. *Aeschna depravata* Hagen, Syn. Neur. N. Amer. p. 314 (Brazil; New Friburg no description).³
 1875. *Aeschna depravata* ♂ Hagen, Proc. Boston Soc. Nat. Hist. XVIII, p. 38 no description (Brazil, New Fribourg. Group of *Ae. armata*).⁴
 1861. *Aeschna lobata* Hagen, Syn. Neur. N. Amer., p. 314 (Brazil; New Friburg no description).⁵
 1875. *Aeschna lobata* ♂ Hagen, Proc. Boston Soc. Nat. Hist. XVIII, p. 38 no description (Brazil, New Fribourg. Group of *Ae. armata*).⁶

Material studied.—All from BRAZIL: "Beschke" placed as *lobata* 1 ♂ (No. 2 P.P.C.), placed as *depravata* 3 ♂ (Nos. L21, L22, L23 P.P.C.) in the M.C.Z.* In Santa Catarina: Jaragua, Rio Laciss, 25.8.1928, Fritz Hoffman,

* The only pin-label, "Beschke", on each of these four specimens evidently corresponds to scattered indications in Hagen's publications, e.g. 1867, Verh. zool. bot. Gesell. Wien 17, p. 49, under *Ae. cornigera*, "aus Neu*Freiburg bei Rio von Beschke, p. 51, under *Ae. castor*, "aus Neu-Freiburg bei Rio von Beschke gesammelt"; 1867, Stet. Ent. Zeit. 28, pp. 286, 287: "Aus Neu-Freiburg bei Rio von Beschke", and to the localities given above by Hagen³⁻⁶ for *lobata* and *depravata*. Specimen no. L21 is now in ANSP as a duplicate from the MCZ. W. Horn 1936, Suppl. Ent. 12: p. 23; 1929, 17 p. 80, and Horn, W., Kahle, I. and Korschefsky, 1935-37, Ent. Beihefte 2-4, pp. 17, 18, 320, spell the name Bescke (Beske), C. F. C., and say of his collections "Brasilien spec. Rio (schon vor 1832, Ost-Africa 1836/38 ex parte direkt (z. B. Mus. Berlin, Halle, Hamburg, Stockholm, etc.), ex parte via M. C. Sommer vereinzelt."

1 ♀ juv. (No. p30 P.P.C.) coll. E. Schmidt, and Nova Teutonia, 18 Jan. 193(6?), 1 ♂ (No. p26 P.P.C.) coll. Kennedy, 8 Dec. 1934, 1 ♂ (No. p27) coll. D. St. Quentin, 9 Jan. 1936, 1 ♂ (No. p28 P.P.C.), 15 Dec. 1934 1 ♀ (No. p31 P.P.C.) coll. ANSP, these 3 ♂ 1 ♀ collected by Fritz Plaumann. Sta. Catarina, no definite locality, Michelis 1 ♂ (No. p25 P.P.C.) ANSP, ex Berlin Museum für Naturkunde, other specimens therein, 1896. Rio Grande do Sul 1 ♂ (No. L24 P.P.C.) MCZ. Total 9 ♂, 2 ♀.

As our figures 424-426, pl. XXXII, show, there is a considerable range of variation in the height of the anteapical arch of the superior carina of the superior appendages of the male. This variation suggested the possibility of there being two or more forms of this species. To test this, repeated measurements in millimeters of the height of this arch were made with the following results:

- (Not measured) ♂ No. L2 Nova Friburgo, original of fig. 424
- (Not measured) ♂ No. L22 Nova Friburgo, original of fig. 425
- .67 mm. ♂ No. p28 Nova Teutonia, original of fig. 426
- .57 mm. ♂ No. p27 Nova Teutonia
- .78 mm. ♂ No. p26 Nova Teutonia
- .57 mm. ♂ No. L21 Nova Friburgo
- .88 mm. ♂ No. p25 Sta. Catarina

In making these measurements, the apical part of the abdomen was placed so that the lateral margin of the left appendage was in the same plane as the upper surface anterior to the arch. Too much reliance must not be placed upon these measurements, however, for a very slight change in the position of the abdomen may cause a significant difference in the resulting measurement. Taking the measurements as here given, however, perhaps the first thing which will strike the reader is that the heights of the arch are not correlated with the geographical localities of the males measured. Thus the three males from Nova Teutonia have heights of .67, .57 and .78 mm., respectively.

Attempts made to correlate the widths of the pale mes- and met-epimeral stripes at their lower ends, the width of the stem of the black T-spot of the frons and slight observable differences in the genitalia of the second abdominal segment of the males with the relative height of the arch of the carina, or with geographical locality, have been unsuccessful. We therefore leave *Ae. punctata* as but one variable form with no variations distinguishable by any nomenclatural device.

Distribution.—Mexico,¹ Brazil: States of Rio de Janeiro, Santa Catarina and Rio Grande do Sul, 22° to 32° South Latitude.

Altitudinal Range.—Sea-level to 500 m. (0-1640 ft.).

Seasonal Range.—At Nova Teutonia, in Santa Catarina, *punctata* has been taken in August, December and January. According to rainfall data for Blumenau in that State, published by Hann,* March, April and December were the wettest months in the eight year record and May and June the driest. *Ae. punctata*, therefore, was flying in a dry (August) and a summer wet (December, January) season. "The south-east of Brazil, Santa Catharina and Rio Grande do Sul, . . . have their rainfall well distributed over the whole year. In most parts summer is the rainiest reason, but some places, as Porto Alegre, have their maximum in the winter months. . . . On the coast between Santa Catharina and Pernambuco there is the normal regime, with most rain in summer. . . . Rio de Janeiro has the comparatively small rainfall of 43 inches, but the air is always moist owing to the strong on-shore winds." †

♂. Upper margin of anterior surface of frons black and below the black narrowly reddish brown, a black line on the fronto-clypeal suture. Dorsal surface of frons with a basal, transverse, black stripe, embracing vertex, ocelli and bases of antennae and continued as a black line along the eye margin of the frons. Stem of the black T-spot of variable width, subuniform, or slightly wider, or slightly narrower at the hind end; bordered laterad by a narrow yellow stripe, this in turn by a greenish blue area extending laterad beyond the level of the pointed end of the top of the T of the same side. Labrum approaching cream color in some, a black line on the clypeolabral suture, distal margin very narrowly edged with brown. Labium pale, obscure yellowish or reddish. Occiput triangular, pale yellow, its three angles black, hind margin straight or slightly concave. Rear of eyes shining black or very dark indian red.

Pronotum blackish, a transverse, sinuous orange line on its anterior division, a transverse, nearly straight orange line on its median division; median division bilobed anteriorly; hind margin in anterior view bilobed and with a row of whitish and pale brownish hairs 1.64 mm. long. Propleura pale clay yellow which extends along the hind margin of the pronotum.

* 1911. Meteor. Ztschft. 27, pp. 323-324.

† Kendrew, W. G., 1930, The Climates of the Continents, 2d edition, impression of 1930, Oxford, Clarendon Press, p. 329.

Pterothorax dark indian red with whitish or pale brown hairs, a greenish or bluish antehumeral stripe on each mesepisternum 2.21-3.60 mm. long, maximum width .74-1.14 mm. at above mid-length, anterior end almost pointed, almost reaching the anterior margin of the sclerite, hind end rounded, not reaching the antealar sinus by .82-1.5 mm.; stripe diverging slightly forward from its fellow of the opposite side, separated by more than its own width from the mid-dorsal carina and from the humeral suture. Midnotal stripe and pale marks in antealar sinus not well developed.

Mes- and met-epimeral stripes pale greenish yellow, pale yellow, or pale blue, reaching nearly, or entirely, for the whole length of their respective sclerites, the mesepimeral nearly straight or a little sinuate, narrowest at or near mid-height, the metepimeral nearly straight, or with the anterior margin slightly convex, posterior margin slightly concave, often decreasing in width from its upper, often ill-defined, end to its lower end.

Legs (Nova Friburgo): femora reddish superiorly, blackish inferiorly; tibiae blackish or reddish above and below, or dark reddish brown above, below blackish; tarsi black; all spines of the legs black.

Abdominal colors (based on 4 ♂ from Nova Friburgo, nos. L2, L21-L23, and 1 ♂ Rio Grande do Sul no. L24). Ground color reddish brown, pale markings pale green. Antero-dorsal AD absent or faded on 1 and 2, on 3 fused or separated on the mid-dorsal line at base but each continued separately caudad as far as the transverse carina; absent or very indistinct on 4-10 in four males but present on 4-7 in L23. Medio-dorsal MD absent on 1, fused on mid-dorsal line with each other on 2; small, transverse, separate on 3-6 or -8. Postero-dorsal PD fused with each other on 1 and 2 to form a transverse pale stripe; on 3-9 separated by mid-dorsal longitudinal brown or black, separation wider on 8 and 9 than on preceding segments. Antero-lateral AL absent on 1, on 2 dorsal to the auricle and extending caudad and dorsad to the transverse carina, on 3 forming a parallel-sided longitudinal band from base to transverse carina, on 4-7 or -8 forming an oblique rather narrow stripe bordering the transverse carina anteriorly, absent or very small on 8- or 9-10. Medio-lateral ML absent on 1, on 2 fused with PL together forming an elongated band from transverse carina to hind end of segment, present on 3-8 as a rather small spot (a fair-sized spot, Nova Teutonia), narrowly fused with MD on 3-7 or 4-7, apparently absent on 9-10. Postero-lateral PL present or absent (faded?) on 1, fused with ML on 2, present as a small spot on 3 (absent Nova Teutonia), doubtful or probably present on 4-7, present on 8- or 9-10; two Nova Friburgo males, nos. L23, L24, have a mid-dorsal and three or four lateral pale dots each side on the intersegmental membrane following each of segments 3-9.

Auricles of abd. seg. 2 each with two distal teeth. Genital fossa divisible into two sections, the boundary between them near the level of the mid-length of the sheath of the penis; margins of the anterior section in ventral view (fig. 427, pl. XXXII) converging caudad more markedly than do those of the pos-

terior section. In profile view the margins of the second section, in their posterior half to two-thirds, are produced ventrad as the genital lobe at about 40° with the lateral margin of the fossa and are armed with spinules which are continued on to the lateral surface of the genital lobe; the genital lobe projects ventrad 1.06-1.32 mm. beyond the lateral margin of seg. 2 and its length measured along the prolonged ventral margin of 2 is 1.88-3.03 mm.

Anterior lamina cleft to, or almost to, the level of the hind end of the sternum of abd. seg. 1, its spines straight in ventral view and reaching almost to the level of the hind margin of the hamular processes, in profile view their apices project hardly, if at all, ventrad to the margin of the genital fossa. Sheath of penis and penis as shown in our figures 427, 437, 438, pl. XXXII. Hamular processes: mesal margin in its anterior half straight and subparallel to, or diverging caudad from, its fellow of the opposite side, the antero-mesal angle ca. 70°-80°, a tuft of hairs present in some on the ventral surface just before the transverse ridge; posterior end rounded, a lateral ridge continued dorsad into the hamular fold.

Dorsum of abd. seg. 10 with a fairly high carinate mid-dorsal tooth near its anterior margin and on each side of it two successively lower and blunter carinae; height and degree of the mid-dorsal tooth, as seen in profile view, variable (figs. 424-426, pl. XXXII).

Superior appendages slightly longer than abd. segs. 9 + 10, not as long as 8 + 9; in dorsal view (figs. 434-436, pl. XXXII) widening on the mesal margin in the proximal half of the appendage length, thence mesal and lateral margins subparallel to nearly the terminal tenth where they converge abruptly to form an apical spine directed caudad, mesad or laterad according to the precise position of the appendage; a superior carina extends for more than the distal half of the appendage. In profile view, approximately straight and horizontal in somewhat less than the proximal half, in the proximal sixth there is a feebly developed inferior longitudinal swelling or tubercle; in the distal half the mesal margin projects ventrad as a convexity reaching to the terminal tenth or less of the appendage length, while the superior carina is arched, in the anteterninal part of the appendage, to a varying degree which has been discussed on page 81 *antea*, the arch showing 0-6 crenulations; the apex forms a sharp spine directed ventrad and caudad in prolongation of the superior carina thus presenting an appearance which has been compared to the beak, or to a claw, of a bird.

Inferior appendage .52-.63 (Nova Friburgo), .6 (Sta. Catarina no. p25), .72 (Nova Teutonia no. p28) as long as the superiors; in profile view concave dorsally, convex ventrally for its entire length; in ventral view triangular, apex .15-.17 as wide as base, terminating in two rounded denticles.

Wings uncolored, or faintly smoky throughout, or paler to the arculus, or each antenodal of the front wings narrowly margined with pale brown. Venation brown or black, costa anteriorly paler or pale brown from nodus to apex. Stigma above roman sepia, below a little paler or approaching burnt sienna. Membranule whitish or bluish white in proximal third, dark brown or brown in remaining two-thirds.

♀. Differs from the male as follows: Face pale violet carmine (Smith's Glossary, pl. IV, no. 7), a yellow spot on each side of the frons (Jaragua); line on fronto-clypeal suture dark brown, blackish at ends (Nova Teutonia), stem of the T-spot wider at its hind end, area following the bordering narrow yellow stripe slate blue (Nova Teutonia) or blackish reaching laterad to the yellow spot mentioned above as on each side of the frons (Jaragua), labrum cadmium yellow (Nova Teutonia) or approaching orange with a black line at base broken into three dashes (Jaragua).

Brown replacing black on the pronotum; antehumeral stripe yellow (Jaragua) or green (Nova Teutonia), 2.04 mm. long and .5 mm. wide, not reaching the antealar sinus by 1.06 mm. (N. T.), separated by much more than its own width from the mid-dorsal carina and from the humeral suture; mes- and metepimeral stripes yellow (J) or pale blue (NT). Tibiae above and tarsi burnt sienna or black.

Abdominal colors: MD separated by mid-dorsal black on 3-7, PD not distinct, AL fused with ML and PL for entire length of 2; AL wide, from base to transverse carina on 3 (NT), a narrow stripe bounding the transverse carina on 4-7 (NT) or on 3-7 (J); ML fused with MD on 3-5, well developed on 6-8 (NT) or 3-9 (J), no PMD, no distinct PL except on 9 of J.

Sternum of 10 armed with $90 \pm$ black spinules, mid-dorsal longitudinal carina very low. Ovipositor projecting caudad beyond the level of the hind edge of the inflexed tergum of 9, genital valves reaching to or slightly beyond that level, lateral genital plates reaching caudad to the level of mid-length of inflexed tergum of 9; see figs. 441 and 442, pl. XXXIII and the explanation thereof. Anal appendages longer than 9 + 10, longer than (NT), or subequal to, 8 + 9, not as long as 8 + 9 + 10, shaped as shown in figs. 441, 443.

Wings uncolored, with (NT), or without (J) a slight cloud surrounding the nodus, stigma above and below pale brown (J) or cadmium yellow (NT), crossed by two veins in the left front wing, by one vein in the right front wing (J); proximal white of the membranule occupying a larger area.

Dimensions.—Total length ♂ 72, ♀ 70 mm. Abdomen (excl. apps.) ♂ 43-51, ♀ 43-47, sup. apps. ♂ 5.15-6.54, ♀ 5.65-6.71, hind wing ♂ 41-51, ♀ 45, pterostigma, front wing, costal edge ♂ 2.70-3.46, ♀ 3.68-3.85 mm. Front wings with 13-20 antenodals, 11-14 postnodals, hind wings with 9-13 antenodals, 10-16 postnodals.

Ecology.—Plaumann has given the following description of his collecting ground at Nova Teutonia* (translated): My activities concern exclusively the fauna of the primitive forest region of the Rio Uruguay near the boundary of the States Sta. Catarina and Rio Grande do Sul 27° 11' S. Lat., 52° 13' West Long. The present area

* 1940. Ueber das Sammeln in brasilianischen Urwald (II), Revista Entom. 11 (3) pp. 908-920, 13 Dez. 1940.

is a mountainous country, about 500 m. above sea-level, covered with a dense, almost untouched primitive forest. The temperature fluctuates between 0° C. and 38° C.; in unusual years we had the following extremes -3° and 41° in the shade. The average precipitation is 200 mm. per year. . . . One meets Odonata near water, but many species are far removed therefrom . . . Brightly colored Odonata must be cut open soon after capture in order to remove the body-contents, otherwise the colors suffer badly.

Discussion.—Martin's description¹ gives the abdomen of the male as 60-64 mm., of the ♀ as 48-50 mm.; these figures for the male abdomen, even if they include the appendages, are so much larger than those for the female that one suspects a lapsus calami. His figure² shows the pale antehumeral stripe as longer and more pale spots on abd. segs. 7-9 than as stated in his description.¹ His figures^{1 2} of the male appendages are good, that of the wings² shows the larger number (4) of rows of cells in the fork of Rs and also an irregular arrangement of the cells in the discoidal triangle of the hind wing; the first of these venational variants is present in our material (see table 15), the second in *decessus* (see table 7). In his copy of,¹ p. 54, E. B. Williamson made the following note: "1 ♂ Selys Coll. Types Coll. Martin. It seems highly probable to me that the species described in key and text¹ is not the species figured. EBW 3/8/26. Described (key p. 82) as without strong tooth on dorsum of 10". On Dec. 1, 1935, Mrs. L. K. Gloyd looked at a ♂ Rio Grande do Sul, H. Smith, in the M. C. Z., Martin's description and the above note by E. B. Williamson and thought the ♂ was probably *punctata*. She suggested that the passage in Martin's key was made from type in his own collection, the description and figure on page 54 from male in Selys' collection. It seems to me (P. P. C.) that the error is in Martin's key, not in his description and figure.

On June 24, 1951, Dr. Erich Schmidt, at my request, kindly examined the types of *punctata* in the Museum Nationale d'Histoire Naturelle at Paris. He wrote as follows in English: "In the 'Collection générale' of the Museum 3 of the studied species are in one box together *Ae. punctata*, *unicolor*, *joannisi*, besides these a specimen of *Ae. marchali*; these 4 species have collection labels. At first *Ae. punctata*: there are 4 specimens, but only the first has denomination

'type' from Martin's hand; this and two others bear printed (red colour) type labels. The first with type label of Martin's hand is surely the holotype. This in pretty good condition and has a printed locality label 'Espirito Santo, Brasil, ex coll. Frühstorfer'. I believe to remember to have seen same printed labels in other Museums. I suppose that these locality labels were made by the clever collector Frühstorfer. The 2nd and 3rd specimens are females in somewhat poor condition, the 3rd has a compressed abdomen, both are from 'Mexique'; although these two specimens bear printed red type labels they cannot be considered as types (from my opinion) as they have not the designation (Bezeichnung) from Martin's hand.* The 4th specimen, a male, is again from Espirito Santo, but without 'ex coll. Frühstorfer'. Holotype: supratrangular cross veins $\frac{3.3}{2.2}$; anal loop 3.3 vertical rows of cells in hind wing. Pattern of 6th abd. seg. holotype; a copy is given here [our fig. 432, pl. XXXII]. In this copy (and also in original) some parts are not explained. I do not know how to make this. The specimens do not show sufficient differences of colours. Perhaps tomorrow I shall try to get better knowledge of patterns after treating the 6th seg. with alcohol. P. S. Paris 25.vi.51. No success with alcohol in *Ae. punctata*."

After leaving Paris, on his return to Bonn, Dr. Schmidt was in Brussels and looked for *punctata* in the Selys collection. He wrote July 10, 1951: "In Brussels Collection generale, is one male, 'type' printed label 'P. Br. (green label)'; another label, white, hand doubtful, but perhaps Selys: *Aeschna punctata* Selys ♂ Bresil /125. I have made only a new sketch of pattern of abd. seg. 6 enclosed [our fig. 433, pl. XXXII]. Perhaps fig. 51 may have been made from this specimen."

In explanation of the preceding paragraph it may be said that Martin's original description¹ of *punctata* says: "Types: ♂ et ♀ coll. René Martin. Coll. Selys 1 ♂" and the legend under his fig. 51 reads "Appendices de *Aeschna punctata* Martin (Coll. Selys)". There

* "My supposition is that the 3 printed type labels should (have been) originally fixed to the supposed holotypes of the three species, *Ae. punctata*, *unicolor*, *joannisi* and the gentleman who perhaps was ordered to do this, was doubtful in *Ae. unicolor* and *Ae. joannisi*. Surely it is a pity there is nobody here who has interest in the group."

would, therefore, seem to be no doubt but that the specimens in Paris are the holotype and paratypes and the male in Brussels also a paratype, all of Martin. "P. Br." which I have seen on labels of specimens in, and proceeding from, the de Selys collection is, I believe, an abbreviation for Paul de Borchgrave, described in de Selys' "Secondes Additions au Synopsis des Calopterygines" (Bull. Acad. roy. Belg., 2me serie, t. XXVII, no. 6, pp. 647 and 659, or 3 and 15 of the separate, 1869) as "mon neveu M. le comte Paul de Borchgrave d'Altona, ministre de Belgique au Bresil, qui a bien voulu me les offrir avec beaucoup d'autres Odonates rares a son retour à l'Europe." In the case of the above-cited male of *punctata* no locality in Brazil is given. In various passages in de Selys' writings, Count de Borchgrave is stated to have collected Odonata at Tijuca near Rio de Janeiro (l. c., p. 659 and t. XXXVII, no. 8, page 191) and at Nouvelle Fribourg (l. c., page 193).

Ae. (H.) decessus Tables 1, 3, 5, 7, 10, 13, 15; Map 1; Text-fig. p. 89.
1953. *Aeshna* (*Hesperaeschna*) *decessus* Calvert, Ent. News LXIV (8), p. 205.

Material studied.—Holotype male and unique specimen: BRAZIL, Südhang Itatiaya-Gebirg., 700 m., Rio de Janeiro, X. 31, Zikan, coll. of Dr. Erich Schmidt, Bonn am Rhein, Germany.

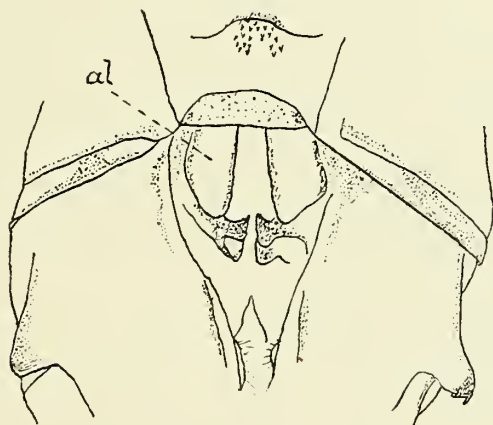
Distribution, altitudinal range and seasonal range known only for the holotype as above.

♂. Face chrome orange, upper margin of anterior surface of frons black, a black line on the fronto-clypeal suture. Dorsal surface of frons with a transverse basal black stripe embracing the vertex, ocelli and bases of the antennae and continued as a black line along the eye-margin of frons, and a black T-spot whose stem is of subuniform width, bordered on each side by a chrome orange narrower stripe .47 mm. wide, this in turn by a purplish area extending laterad beyond the level of the pointed end of the top of the T of the same side. Labrum chrome orange, a black line on the clypeo-labral suture, distal margin hardly edged with brown. Vertex chrome orange, margined with black laterally and posteriorly.

Pronotum chrome orange, a pair of black dots on its middle division; white and pale brownish hairs 2.04 mm. long on the hind margin.

Pterothorax burnt siena; a greenish antehumeral stripe 2.86 mm. long not reaching the antealar sinus by 1.00 mm. and barely diverging from its fellow of the opposite side. Tibiae reddish both superiorly and inferiorly.

Ground color of the abdomen reddish brown, dorsum of 10 chiefly chrome orange, the following pale markings pale green or pale blue: AD present as a mid-dorsal stripe on segment 2, very indistinct or faded on 4-8, present on 9; MD a small transverse spot on 4-9, separated from its fellow of the opposite side, fused with PMD on 4-7; PD a pair of large spots on 3-9, separated by mid-dorsal brown or black, the separation wider on 8 and 9 than on preceding segments; AL present on 1-8, fused with ML and PL on 1; ML present on 3-9; PL present on 4-9, fused with ML on 4-8.



Ae. (Hesperaeschna) decessus Calv. 1953. Ventral view of genitalia of second abdominal segment of male holotype, Itatiaya-Gebirg, Rio de Janeiro. al anterior lamina, without spines. Compare figs. 7, plate I (*Coryphaeschna adnexa*) and 427, plate XXXII (*Hesperaeschna punctata*), both with spines on the anterior lamina.

Spines completely absent from the anterior lamina. Genital lobe projecting 1.00 mm. beyond the lateral margin of abdominal segment 2, width at base, measured along the prolonged ventral margin of 2, 2.45 mm.

Superior appendages very similar to those of *punctata*, the arch of the superior carina and the depth of the appendage below the lateral margin, as seen in lateral edge view, the same as in a male of *punctata* from Nova Teutonia, Brazil.

Venation in the anterior half of each wing with a reddish yellow tinge. Pterostigma brown ochre above, clay yellow below. Membranule pale clay yellow in its proximal .36, brown grey in the distal .64. Cells in the discoidal triangle of the front wings 7 right, 6 left, of the hind wings 7 right, 6 left, 2 cells on the proximal side in all four.

Dimensions.—Total length 78 mm. Abdomen (excl. apps.) 59, sup. apps. 5.73, hind wing 51, its maximum width 16, pterostigma, front wing, costal margin 2.95 mm. Front wings with 20 antenodals, 18 and 19 postnodals, hind wings with 14 antenodals, 23 postnodals.

Discussion.—This male was at first identified by Dr. Schmidt and by myself as *punctata* Martin until finding that no spines are present on the anterior lamina removed it from that species. *Ae. decessus* is almost unique among neotropical Aeshnas by the chrome orange color on the head. In this respect it is most closely approached by *biliosa* Kennedy in which the head of the male is colored with bright chrome lemon. The pale colors of the head of most species of *Hesperaeschna* are blues or greens. The combination of chrome orange on the head and the absence of spines from the anterior lamina distinguishes *decessus* from all its allies. The collectors' (Zikans') note on the type locality of *decessus*, the Itatiaya Mountaons, has been given at the end of the article on *cornigera planaltica*, antea, page 48.

Ae. (H.) variegata Tables 1, 3, 5, 7, 10, 13, 15; Pl. XXXV; Map 1.

1775. *Aeshna variegata* Fabricius, Syst. Ent. :425.¹
 1781. *Aeshna variegata* Fabricius, Species Insect. I:526.²
 1787. *Aeshna variegata* Fabricius, Mantissa Insect. I:339.³
 1793. *Aeshna variegata* Fabricius, Ent. Syst. II:384.⁴
 1861. *Aeschna variegata* Hagen, Synop. Neur. N. Amer. :314.⁵
 1875. *Aeschna variegata* Hagen, Proc. Boston Soc. Nat. Hist. XVIII: 38.⁶
 1887. *Aeschna variegata* McLachlan, Ent. Mo. Mag. XXIV: 77.⁷
 1888. *Aeschna diffinis* Mabilie, Miss. Sci. Cap Horn VI :Diii, figs. 1-1c (in colors, entire ♂ ♀, apps. ♂ ♀).⁸
 1904. *Aeschna diffinis*: *c* Ris, Hamburger Magal. Sammelr. Odon.: 27, figs. 13 (venation), 14 (larva).⁹
 1909. *Aeschna variegata* Martin, Colls. Zool. Selys-Longchamps Cat. Syst. Descr. fasc. XVIII: 44.¹⁰
 1912. *Aeschna diffinis* var. *risi*, Enderlein, Svensk. Vet.-Akad. Handl. 48 (3): 119.¹¹
 1913. *Aeschna variegata* Ris, Mem. Soc. Ent. Belg. XXII: 81, fig. 22 (venation).¹²
 1918. *Aeschna variegata* Ris, Arch. Naturges. 82 (A) (9): 159, 162.¹³
 1924. *Aeschna variegata* Martin, Rev. Chilena Hist. Nat. XXVII: 109.¹⁴

Material studied. BOLIVIA: Province of Chapare, Dept. Cochabamba, III.19, coll. F. Steinbach 1 teneral ♂, coll. C. H. Kennedy. ARGENTINA: San Ignacio, March 22, 1908, perhaps by Jensen-Haarup

1 ♂, Mus. Zool. Univ. Mich., Nahuel Huapi, II.1948, A. Breyer, 1 ♂ MB, III 1 ♂, VII 1 ♀, Mus. Zool. Univ. Tucumán. CHILE: Quebrada El Gheeso, Taltal, 11 Enero, 1942, Javar 1 ♀ coll. J. G. Needham; Malvilla, Santiago province, 2.1.1948, Sergio Barros Valenzuela 1 ♂, coll. M. A. Lieftinck; Angol, 18 Jan., 1942, D. S. Bullock 1 ♂, coll. J. G. Needham; Island Harbor, Patagonia, Acc. 21699 U[nited] S[tates] F[ish] C[ommission] 2 ♂ U. S. National Museum. Total 8 ♂, 2 ♀.

Remarks on the preceding data: Of all the material listed, the males from Island Harbor, Patagonia, most nearly approach the locality, Terra del Fuego, of Fabricius's type specimen.¹ Since Island Harbor is not shown on the large series of maps of Hispanic America published by the American Geographical Society of New York, nor included in the indexes to that series, nor in other maps accessible to me, it seems worth while to record here such information that I have been able to obtain on its location. As it is situated on the west coast of South America, it is not within the political Patagonia of recent maps, a part of Argentina, but in Chile. Earlier usage of the term Patagonia included present day Chile, as is exemplified by the book of Robert O. Cunningham "Notes of the Natural History of the Strait of Magellan and West Coast of Patagonia made during the Voyage of H. M. S. 'Nassau' in the years 1866, 67, 68, & 69. Edinburgh Edmonston and Douglas 1871." Cunningham's map, facing the table of contents, p. xi, shows an Island Harbor on the west coast of Patagonia, in longitude east of 75 W., a little farther south than the northern end of Wellington Island, Wellington Island as separated at its southern end from the continent by "Wide Channel" and farther north as separated from the continent by "English Narrows".

On applying to Mr. Albert M. Day, Director of the United States Fish and Wild Life Service, for information from the records of the U. S. Fish Commission as to the location of Island Harbor and pertinent data on the specimens of *Aeshna variegata* taken there, my letter was referred to Dr. Ashley B. Gurney, of the Bureau of Entomology and Plant Quarantine. Dr. Gurney wrote me on Nov. 21, 1952, as follows: "The natural history material under this Accession Number, 21699, was taken by naturalists of the Fisheries Commission who were on the steamer Albatross during a voyage from Virginia

to California in 1887-88. The accession records of the Museum include a brief listing of the insect material made by C. V. Riley December 20, 1889. The only insects attributed to Island Harbor, Patagonia, were two alcoholic ones taken February 3, 1888, under catalogue number 665. It is not stated what group of insects were represented, but they probably are the specimens loaned to you. Names of collectors are not now available, but probably could be obtained from other old records. All that I have found on Island Harbor is on page 405 of a volume entitled 'Sailing Directions for South America, vol. 2 (Southern Part)', 4th Edition, 1941, issued as Number 173 of the U. S. Navy Hydrographic Office. It is described as near Phipps Island and Lizard Island on the eastern shore of Messier Channel, at approximately 48° 27' South, 74° 29' West. We have some aeronautical charts to most of the world in a series that appeared during the recent war. Messier Channel appears there, but I have not located Island Harbor, which evidently is of relatively minor importance. The records show where collections were made on February 1, 2 and 5, all of which localities are listed in the same Navy Department volume, and it is evident that the Albatross was passing among the islands on its voyage from east to west, making stops for collecting purposes along the way."

Mrs. Venia T. Phillips, librarian of the Academy of Natural Sciences of Philadelphia, has kindly copied for me the following statements from the U. S. Navy Hydrographic Office No. 173, mentioned in Dr. Gurney's letter, from a copy in the Free Library of Philadelphia. "Island Harbor on the eastern shore of Messier Channel, 12 miles northward of Cocks Head, is a small anchorage with good holding ground, convenient for vessels entering or leaving Messier Channel. Its position is marked by Lizard Island which lies 1 mile to the southward and near the entrance are two small islands named Brown and Phipps Islands. A bank or bar of rocky ground stretches across from Phipps Island to the mainland on each side, having 8 fathoms on it in midchannel and shoaling gradually to 3 or 4 fathoms on either side close to the rocks. There is a patch with $2\frac{1}{4}$ fathoms on it about 100 yards southward of Phipps Island and a group of rocky islands, surrounded by kelp, lies off the southern point of the mainland. The island can be passed on either side but the narrow passage is the

straighter. The anchorage is in 19 fathoms about 225 yards northward of Phipps Island. A small vessel can go into the inner basin and anchor in 10 fathoms close to the large waterfall at the head of the bight, but her stern must be secured to the trees, as there is not room to swing. There is an anchorage outside of the harbor in 15 fathoms of water, with Fleuriats Point bearing 353° and the southern point of Phipps Island 60° . The commanding officer of the U. S. S. *Pinta* (in 1884) reports that Island Harbor is a poor anchorage in bad weather and there is scant room to turn without a spring. The land is low to the northward and westward and very high in the opposite direction; therefore there is little protection from prevailing gales. The vessel rode out two gales there, force 5 to 12, dragged two anchors, and had to steam up to them most of one day and all of one night. The water was smooth enough, but some of the squalls were terrific . . . From the northern entrance of English Narrows to the outlet of Messier Channel at Tarn Bay in the Gulf of Penas, a distance of about 75 miles, the land on both sides of this channel is mountainous, with lofty snow-capped peaks. It is quite open, has several bold headlands, indentations and islands, but free from all impediments, except for Cotopaxi Rock." p. 402.

Channel Mesier (with one s) and Canal Ancho (English Narrows?) are shown in the National Geographic Society's map of South America of 1942.

The Island Harbor males furnish the originals of figs. 467, 469, 470, 472-474 and 477 of our plate XXXV.

As Fabricius stated¹ that he described *Ae. variegata* from a specimen in Mus. Dom. Banks, it seems probable that it was collected on Lieut. (later Capt.) James Cook's first voyage around the world, 1768-1771, in which (later Sir) Joseph Banks took part.* In that case the specimen was obtained in January, 1769, 1 ♂, possibly by Banks himself; "it no longer exists in Mus. Banks and has probably been long ago destroyed."^{7 9}

As to San Ignacio, the index to the Millionth Map of Hispanic America by the American Geographical Society of New York gives

* Journal of the Right Hon. Sir Joseph Banks During Captain Cook's First Voyage in H. M. S. *Endeavour*, etc. Edited by Sir Joseph D. Hooker, London & New York, Macmillan, 1896, pp. 47-62.

13 San Ignacios in Argentina. Jorgensen * gives a San Ignacio at 1325 meters on the Ferro-Carril Transandina, on the Rio Mendoza, and I hazard the guess that this is the locality of the *variegata* male.

Distribution.—Bolivia, province of Chapare, to Tierra del Fuego, 15° to 55° South Latitude.

Altitudinal Range.—From 1325 m. (4350 feet) to sea level at Taltal, Concepcion¹³ and Tierra del Fuego.¹²

Seasonal Range.—January to April 12.

♂. Face clay yellow (Smith's Glossary) in one male from Island Harbor pale pink in the other, upper margin of anterior surface of frons narrowly black, below the black narrowly reddish in one male each from Nahuel Huapi, Angol and Chapare; fronto-clypeal suture with a black line, a little wider at each end in the Island Harbor males, pale brown in the teneral male from Chapare. Frons superiorly with a transverse black stripe in front of the eyes and embracing the vertex, ocelli and bases of the antennae and continued along the eye margin of the frons to join the black fronto-clypeal sutural line; stem of the black T-spot with sides converging cephalad to just behind where it joins the top of the T and bounded on each side by a yellow or pale green stripe of subuniform width, .5-.9 mm., narrower than or subequal to the stem at its posterior end, but wider than the stem at its anterior end; this yellow or pale green stripe followed laterad by a purplish or bluish spot which reaches laterad beyond the level of the rounded or acute end of the top of the T of the same side. Labrum variable, clay yellow, pale cream, cadmium yellow, blue or pale green, distal margin narrowly edged with black, a black line on the clypeo-labral suture. Labium variable, clay yellow, pale blue, pale pink, or pale reddish with the lateral fourth pale green. Vertex pale green or yellow, margined with black posteriorly and laterally. Occiput triangular, pale yellow, its three angles black, a pale brown central spot in the Island Harbor males, hind margin nearly straight. Rear of eyes black, or indian red (Smith's Glossary) in part.

Pronotum black, propleura pale brown ochre, middle division bilobed anteriorly, hind division bilobed posteriorly, hind margin with a row of pale erect hairs.

Pterothorax brown pink (Smith's Glossary) or blue green, with pale brown and whitish hairs, no pale antehumeral marking, even after treatment of a well-colored specimen with 95% alcohol. The two lateral stripes a little sinuous, yellow or bluish, the mesepimeral widest at its lower end, narrowing upward, reaching part way to the upper margin of its sclerite; metepimeral narrower at its lower end than the mesepimeral, of subuniform width, reaching

* Rehn, James A. G., 1913, Proc. Acad. Nat. Sci. Phila., LXV: 274.

to the mid-posterior margin of its sclerite, anterior margin a little convex, posterior margin a little concave.

Legs entirely black, pale brown in the teneral Chapare male, or with the coxae and trochanters, or the proximal half or two-thirds of the second and third femora, burnt sienna or reddish brown.

Ground color of abdomen burnt sienna on 1-6 or -7, or black on 3-10, with the following pale spots: AD blue on 1; MD blue on 2, yellow or faded to brown ochre, or blue, on 3-7 or -8, triangular, separated from fellow of opposite side by a mid-dorsal black stripe; PMD blue on 6 and 7 immediately following MD, indistinct on 5, or burnt sienna on 3-7, not fused with any other pale spot; PD blue on 2, fused with fellow of opposite side and with MD, blue on 3-10, separated from fellow of opposite side by a black mid-dorsal stripe which is wider on 8 and 9; AL on 2 yellow below, becoming blue above, or faded to brown ochre, with a blue to yellow vertical stripe running dorsad on the anterior side of the transverse accessory carina, on 3-8 blue decreasing in size caudad; ML on 2 yellowish or bluish, fused with PL, on 3-7 blue, increasing in size from 3 to 7, smaller on 8, absent from 9, present on 10; PL on 1 and 2 yellow or blue, on 2 confluent with ML and in contact with the large blue PD, on 3-8 blue, small and ill defined, or larger on 8-10, on some or all of 3-8 confluent or not confluent with PD; inflexed ventral parts of terga of 1-9 obscure reddish or pale green; sternum of 1 obscure reddish, of 3-9 black, or posterior half of 9 pale green or yellow. The abdomen of the teneral Chapare male is contracted and shriveled.

Auricles of abd. seg. 2 with two posterior denticles. Segment 1, in profile view, with a transverse, dorsal, rounded ridge in its posterior half, bearing pale hairs half as long as the height of the segment, similar hairs on the side in the lower half. Anterior lamina cleft almost to the anterior end of the genital fossa, obscure clay yellow, mesal margin brown or black, or brown predominating over the clay yellow, and in some with a row of hairs .16 mm. long, spines black, reaching caudad beyond the level of the hamular processes; hamular lobes well developed.

Superior appendages in dorsal view fairly straight, subequal in length to abd. segs. 9 + 10 or 8 + 9, but shorter than 8 + 9 + 10, lateral margins nearly straight in the proximal 7/10 of appendage length, thence slightly convex to the apex which is rounded or obliquely truncated caudad and laterad; mesal margin widening in the proximal third to .4 of appendage length, thence concave and subparallel to the lateral margin; maximum width .82-.98 mm. at .38-.6 of appendage length, a superior longitudinal carina for the distal 2/3 of the appendage length; in profile view the lateral margin is nearly straight, the superior carina elevated in the distal .4, a distinct, inferior, subbasal tooth at 1/6 to 1/7 of the appendage length, apex rounded, not hooked ventrally.

Inferior appendage in profile view reaching to .5-.6 of the length of the superiors, dorsal margin concave, ventral margin convex for entire length; in

dorsal or ventral view triangular, apex .18-.26 as wide as base, ending in two upturned denticles.

Wings colorless or pale yellow at base to the first antenodal. Venation dark brown or black, but costa, R and M1 and some nearby cross-veins pale clay yellow. Pterostigma variable in color, above cologne earth, vandyke brown, brown ochre or burnt sienna, below vandyke brown, burnt sienna, pale brown ochre, gamboge or cadmium yellow, in some paler at the margins; in the teneral Chapare male the stigma is pale brown. Membranule bluish white in almost the proximal half, the remainder brownish.

♀. Differs from the male as follows: Frons anteriorly brown pink to olive green, clypeus pale brown or as in the male. Fronto-clypeal suture with a pale brown line margined above and below by a pale green line. T-spot of frons brown, ill defined, yellow on each side of the stem narrowing forward, narrower than the stem, or as in the male, followed laterad by a brown spot. Labrum pale brown (Nahuel Huapi) or cadmium yellow (Taltal), distal margin narrowly edged with darker brown, black line on clypeo-labral suture very narrow. Labium clay yellow (NH) or pale brown pink (T). Rear of head burnt sienna (NH) or black (T). Pronotum clay yellow (NH) or pale brown (T). Pterothorax brown pink (NH) or blue green (T), lateral stripes bright yellow (NH) or faded, mesepimeral pale green (T). Abdomen compressed, ground color ochraceous, following pale spots distinct: MD on 3-8 bright yellow (NH), faded on 6-8 (T), PD on 3-5 (NH) or on 3-7 (T) bluish, AL on 2 yellow or blue with a vertical stripe running dorsad in front of the transverse accessory carina and confluent with ML and PL, on 3-8 (NH) or 3-7 (T) yellow or bluish, ML on 2-8 bluish or yellow, PL on 2-7 (NH) or 2-5 (T) bluish; 9 and 10 largely brown ochre (NH) or similar to 8 (T). Ovipositor and genital valves reaching to level of hind end of tergum of 9, palps of genital valves .65 mm. long, black with the usual tuft of pale apical hairs. Lateral genital plates reaching caudad to slightly more than mid-length of tergum of 9. Sternum of 10 with $80 \pm$ (NH) or 110 (T) black spinules, faintly grouped in two bilaterally symmetrical areas, dorsum of 9 and 10 without the pits of the male. Appendages lost (NH), longer than 9 + 10, shorter than 8 + 9, lanceolate, lateral margin nearly straight, mesal margin convex, maximum width .9 mm. at .54 of appendage length, apex rounded (T).

Dimensions.—Total length ♂ 60 mm., ♀ 62, abdomen (excl. apps.) ♂ 35-44 ♀ 37-42, sup. apps. ♂ 4.42-5.24, ♀ 4.58, hind wing ♂ 37-41, ♀ 39-42, pterostigma, front wing, costal edge ♂ 2.13-2.86, ♀ 2.70-3.35 mm. Front wings ♂ ♀ with 12-16 antenodals, 7-12 postnodals, hind wings with 8-11 antenodals, 8-14 postnodals.

Ecology.—Data concerning the localities in which *variegata* has been taken are given on a preceding page 91 under "Remarks". For Island Harbor a further statement from Cunningham's book there cited

may be added here: Cunningham, with Dr. Campbell, landed at Island Harbor on two occasions, the first in April, 1868, and gives descriptions of some plants observed there, pp. 345-7, 356-9. The nearest meteorological stations to Island Harbor are Evangelistas and Punta Arenas, at $52^{\circ} 24'$ and $53^{\circ} 10'$ South Latitude respectively, with average yearly precipitation of 119.33 and 18.86 inches respectively. At Evangelistas no month has an average rainfall of less than 8.59 inches, the wettest months are December to April. At Punta Arenas the driest month is October (.85 inches), the wettest April (2.03 inches) and May (2.59). For *variegata* the recorded months of capture in Tierra del Fuego are January and February which do not appear to have a seasonal significance. Ris⁹ records a larva, which he refers to *variegata*, as from a fresh-water lake in the forest, at Harberton in southern Tierra del Fuego and quotes Dr. Michaelsen, the collector, as writing (translated): Large Aeschnids, which seemed similar to those at Punta Arenas, often swarmed in the neighborhood of the lake from which the larva came, but they flew so fast and in starts that I could not catch them. Harberton is shown in the National Geographic Society's map of South America as on the north bank of Beagle Channel at almost 55° South.

Discussion.—The specimens which Mabilie⁸ described and figured as *diffinis* Rambur were 7 males, 1 female, collected in Tierra del Fuego by Dr. Hyades chiefly in the neighborhood of Orange Bay and Oushouia. Oushouia, also spelled Ushuaia, also is on the north bank of Beagle Channel west of Harberton. I have carefully studied Mabilie's description and figures. The figures seem to have been carefully drawn, especially as regards the venation. Ris¹² referred Mabilie's *diffinis* to *variegata* and I agree. There is one item in Mabilie's description which differs from Ris's descriptions^{9 13} and my specimens, viz. "Appendices supérieures . . . sans aucune trace de dents". Ris has not commented on this disparity.

Ris's descriptions^{9 13} give the face of the male as from greenish yellow to pale yellow, the sides of the stem of the T-spot parallel, the yellow which borders the stem on each side followed by diffuse grey, the metepimeral pale stripe ("hintere Binde") twice as wide at its dorsal posterior end (as at its lower end).

M. René Martin wrote to me on 9 Dec. 1921, from Villa Alemana, a small village between Valparaiso and Santiago, Chile, after he had been residing in that country for a year or more (translated): "*Aeschna variegata*. The only clear (net) character is the width of the frons (5.5 mm.) to separate it from *diffinis* (3.8 mm.), although I have some *diffinis* measuring 4 and 4.8 mm. The other characters are not clear (net). The reticulation in *diffinis* is sometimes open, sometimes very dense. The body of *diffinis* varies enormously in robustness, in its fusiform shape, in the thorax and the abdomen more or less hairy. The stigma is ordinarily reddish brown with the distal end rarely paler; it varies from 2.5 to 3 mm. Twenty percent of *diffinis* have the supratrangular space reticulated with 1, 2 or even 3 veins. Would not *variegata* be only a robust form of *diffinis* with a remarkably wide frons, inhabiting the south of Chile?" M. Martin published some of these remarks in his paper of 1924.¹⁴ They may be compared with our present tables 1, 2, 3, 7, 8, 11, 15 and 17.

Subgenus **Rhionaeschna**

1909. *Rhionaeschna* Foerster, Jahrb. Nassau. Ver. Naturk, Wiesbaden 62:220.¹

1913. *Rhionaeschna* Ris, Mem. Soc. Ent. Belg. 22:83.²

The generotype and only known species of *Rhionaeschna*, *maita* Foerster,¹ agrees with the following characters of *Hesperaeschna* Cockerell:

M3 and M4 separated by one cell only at the margin of the wing but a short distance before by two rows of cells, owing to the deflection of M4 from the straight course; upper branch of Rs nearly in a line with the stem; Rs separated from Rspl by only three rows of cells; fork of Rs a short distance before the beginning of the stigma; the presence of a ventral tubercle on the first abdominal segment; supratrangular cross-veins present; males with a median dorsal carina on abdominal segment 10, superior appendages in lateral view not bifid nor with an anteapical ventral point, anal triangle of hind wings 3-celled.

Information as to whether another character of *Hesperaeschna* exists in *Rhionaeschna* is lacking: the presence of two lateral pale thoracic stripes. Dr. Erich Schmidt, who examined one of the two cotypes of *maita*, reports "Thoraxzeichnung nicht erkennbar". If freshly colored examples of *R. maita* should prove to possess pale lateral

thoracic stripes, the only remaining differences between *Rhionaeschna* and *Hesperaeschna* are (1) what Cockerell called the cell formula of the (discoidal) triangles, that of *Rhionaeschna* being 1,1,1 for the front wings and 1,1 for the hind, in *Hesperaeschna* 2,1,1 or 2,1,1,1 on front and hind wings; (2) the ratio of frons width to head (eye) width 1:1½ in *Rhionaeschna*, nearer to 1:2 in *Hesperaeschna*; (3) abdomen feebly swollen at base and hardly constricted at segment 3 in *Rhionaeschna*; (4) M1 and the anterior branch of Rs feebly curved in the region of the stigma in *Rhionaeschna*, more strongly so in *Hesperaeschna*; (5) the internal triangles 1-celled in *Rhionaeschna*, 2-celled in *Hesperaeschna*.

Ris² expressed the opinion that (translated) the wide frons is doubtless very important but in this case not a generic character. If these remaining differences and the pale lateral thoracic stripes should prove to be not sufficient to separate *Rhionaeschna* and *Hesperaeschna*, the name *Rhionaeschna* has four years' priority.

Aeshna (*Rhionaeschna*) maita Tables 7, 10, 13, 16; Pl. XXV, figs. 323-327; Map 1.

1909. *Rhionaeschna maita* Foerster, Jahrb. Nassau. Ver. Naturk. Wiesbaden 62:221.¹

1911. *Rhionaeschna maita* Martin, Gen. Ins. fasc. 115:13.²

1913. *Rhionaeschna maita* Ris, Mem. Soc. Ent. Belg. 22: 83.³

No material seen.

Distribution.—Known only from the type locality, Arequipa, Peru¹

Habitat.—Arequipa, Peru, 2300 m. elevation, 14 April, 1907, K. Seyd collector,^{1 2} cotypes in Wiesbaden.

Mr. John Cowley wrote on 23 Oct., 1936, "In the original description Foerster stated 'Beschrieben nach 2 ♂ . . . Die eine der Typen befindet sich in Museum zu Wiesbaden, die andere wurde in zuvorkommender Weise meiner Sammlung überlassen'. Mrs. Gloyd was unable to find the cotype in the Foerster Collection at Ann Arbor; an inquiry addressed to Herr Custos Chr. Fetzer, Mus. Wiesbaden, determined that the second cotype was in that Museum and a loan of the type was made to Dr. Erich Schmidt. Dr. Schmidt supplied me with the following notes." These notes dated 23 June and 28 Aug., 1935, are incorporated in the following description.

♂. (From the description by Foerster, notes and drawings by Dr. Erich Schmidt and a photograph of an entire insect by Custos Chr. Fetzner furnished by Mr. John Cowley.)

Face pale reddish brown; frons blue above, sulcus in front of the median ocellus with a black circular spot surrounded by pale blue, frons without an anterior carina, rhinarium pale. Width of eyes $1\frac{1}{2}$ times width of frons. Labrum yellowish white, labium pale, vertex and occiput paler.

Pterothorax blue green, sutures and metastigma indistinct, brown or black, with whitish grey tomentum, no thoracic markings recognizable. Tibiae yellow, distal end black.

Abdomen slender, only slightly swollen at base, segment 3 barely constricted. Abdomen bluish grey or blue, basal half of segment 1 black above, segment 2 in the middle with a fine double band [color?], interrupted in the posterior half of the segment by a longitudinal black stripe, on each side of which is a distinct figure 1 placed obliquely; segments 3-10 with a dorsal, black, more or less distinct saddle-shaped spot occupying almost the entire segment but leaving free blue anterior [AD] and posterior [PD] spots; the blue [AD] predominate on 3-5 and PD on 10; no blue recognizable on sterna of 9 and 10. Sternum of 1 with a small tubercle smaller than in *bonariensis* or *cornigera*. No processes on the anterior lamina, hamular processes acute anteriorly.

Superior appendages reddish brown, darker at the base, lanceolate, inner margin densely ciliate, apex acute. In the cotype examined by Dr. Schmidt there is no basal tooth, the left appendage is hypotrophied; the right appendage in dorsal view shows two longitudinal sulci, in lateral view the apex is bent strongly upward.

Inferior appendage two-thirds as long as the superiors, narrowly triangular.

Wings hyaline, costa anteriorly and antenodals in costal and subcostal spaces yellow, other veins black, stigma blackish brown, surmounting more than 2 to 3 cells, membranule pale greyish brown, anterior margin yellowish white.

Dimensions.—Total length 69 mm. Abd.?* Sup. apps. 5; hind wing 43, maximum width between arculus and nouds 13.5; pterostigma, 2.5 mm. Front wings with 13 antenodals, 1st and 5th thicker,* 11 postnodals; hind wings with 8 antenodals, 1st and 5th thicker, 12 and 13 postnodals.

Subgenus *Schizuraeschna*

1952. *Schizuraeschna* Calvert, Ent. News 63: 256 (generotype *Aeschna multicolor* Hagen 1861).

*Foerster's description apparently contains some errors: the wing expanse is given as 62 mm., while the hind wing is stated to measure 43 mm.; the abdomen, without appendages, $4\frac{1}{2}$ mm.; for subostal space one should probably read submedian and for 1st and 4th antenodal cross-veins thickened, 1st and 5th, according to the photograph of the holotype, reproduced as our fig. 323, pl. xxv.

Diagnosis.—Abdominal segment 1 with a ventral tubercle bearing spinules or hairs or both, supratrangular cross-veins present, pterothorax with two oblique pale lateral stripes, two rows of cells between M1 and M2 beginning distal to the stigma or under the distal end thereof; males with a mid-dorsal longitudinal carina on abdominal segment 10, superior appendages in lateral edge view bifid in apical fourth or less, the lower division much shorter than the upper and in one species (*dugesi*) reduced to an inferior anteapical point, hind wings with anal triangle 3-celled.

A key to the species is given antea, page 12.

Description of features common to the three following species of this subgenus in addition to those given above under diagnosis and not repeated in the specific descriptions. Face pale blue in males, obscure olivaceous or blue green in females, fronto-clypeal suture with a pale brown line, upper surface of frons with a transverse black stripe in front of median ocellus, bases of antennae and continued along the eye-margin of frons and of clypeus; stem of the black T-spot with sides converging cephalad and bordered with pale blue or yellow, which is narrower than the stem, followed laterad by darker blue or greyish blue. Labrum pale greenish blue, basal and distal margins each with a black line, often very fine. Labium pale bluish, in some with pink. Vertex pale blue or yellow margined with black. Occiput pale bluish or yellowish, its lateral angles or lateral margins black, hind margin from barely concave to slightly bilobed. Rear of eyes black or with some dragon's blood (Smith's Glossary) to indian red.

Prothorax pale brown, pronotum darker. Pterothorax brown pink, vandyke brown or roman sepia in males, pale olive or pale clay yellow in females, with pale brown and whitish hairs, a blue or yellow antehumeral stripe differing according to species, pectus pale brown without blue markings. Legs dark brown to black, first femora pale blue or green inferiorly, third femora reddish brown in proximal half or more.

Abdomen with a tuft of whitish hairs on each side of the posterior half of segment 1, ground color of abdomen from brown ochre anteriorly to black apically, with pale spots blue or green in males, brown ochre in some females, as follows: MD on segments 2- or 3-7 or 8, PD on 1 or 2-9 or -10, AL on 1- or 2-7-9, ML on 2 or 3-8 or -9, PL on 1-3-7-10, mostly confluent with PD; inflexed ventral part of terga of 3-9 reddish with a longitudinal bluish streak on each side of most of them, some with an isolated blue spot at the hind end of each; sterna where visible black, but posterior half of that of 9 and all of that of 10 pale brown ochre (blue in life?).

Males with the auricles of abd. seg. 2 with two acute denticles on the hind margin; anterior lamina cleft to, or almost to, the anterior end of the genital fossa, yellowish, mesal margins of the cleft black or brown, spines almost straight and parallel in ventral view, their apices reaching to or beyond the

level of the hind ends of the hamular processes, sheath of penis anteriorly pointed, posteriorly rounded; hamular processes with antero-mesal angle acute, a tuft of hairs (not shown in our figures) projecting caudad beyond the posterior margin for almost as far as the length of the mesal margin; these hairs can not always be seen in undissected specimens; hamular folds diverging caudad, hind ends roundly pointed; genital lobe in profile view sub-quadrangular, connected with the auricle of the same side by a biarcuate, posteriorly forked carina, ventral margin finely denticulated posteriorly.

Females: ovipositor and genital valves reaching to the level of the hind end of the tergum of 9, palps of the genital valves .5-.6 mm. long with the usual distal pencil of yellow hairs .5 mm. long; lateral genital plates reaching to about 1/3 the length of the tergum of 9; hind margin of the bilobed basal genital plate almost in the same straight line or convex; sternum of 10 with numerous black spinules.

Wings colorless, costa to beyond the stigma pale brown, subcosta, radius and M1-3 at least as far as the nodus reddish brown or brown ochre, remainder of venation darker brown. Pterostigma surmounting 2+ cells, above burnt sienna, below gamboge or pale cadmium yellow or brown ochre, or brown ochre above and below.

- Ae. (Sch.) multicolor** Tables 1, 3, 5, 7, 10, 13, 16; Pl. XXVII; Map 4.
1861. *Aeschna multicolor* Hagen, Syn. Neur. N. Amer. 121.¹
1873. *Aeschna multicolor* Hagen, Rept. U. S. Geol. Surv. Terr. 1872: 727.²
1874. *Aeschna multicolor* Hagen, Rept. U. S. Geol. Surv. Terr. 1873: 591.³
1875. *Aeschna multicolor* Hagen, Proc. Boston Soc. Nat. Hist. xviii: 33.⁴
1895. *Aeschna multicolor* Calvert, Proc. Calif. Acad. Sci. (2) iv: 508, pl. xv, figs. 25, 26 (apps. ♂).⁵
1902. *Aeschna multicolor* Calvert, Trans. Amer. Ent. Soc. xxix: 43.⁶
1903. *Aeschna multicolor* Currie, Proc. Ent. Soc. Wash. v: 303.⁷
1905. *Aeschna multicolor* Currie, Proc. Ent. Soc. Wash. vii: 18.⁸
- 1905, 1907. *Aeshna multicolor* Calvert, Biol. Centr.-Amer. Neur. 180, 183, 400.⁹
1908. *Aeshna multicolor* Williamson, Ent. News xix: 264-271, 301, fig. p. 265 (apps. ♂).¹⁰
1912. *Aeshna multicolor* Walker, Univ. Toronto Stud. Biol. Ser. 11: 62, 66, 190, pls. 14, 17, 21, 28 (many figs.).¹¹
1913. *Aeshna multicolor* Kennedy, Proc. U. S. Nat. Mus. 46 (2107): 113.¹²
1915. *Aeshna multicolor* Kennedy, Proc. U. S. Nat. Mus. 49 (2107): 266, 270, 313, 338, 344.¹³
1917. *Aeshna multicolor* Kennedy, Proc. U. S. Nat. Mus. 52 (2192): 20 refs.¹⁴
1917. *Aeschna multicolor* Kennedy, Bull. Kanas Univ. 18 (1): 139.¹⁵
1918. *Aeschna multicolor* Ris, Arch. Naturgesch. 82 A (9): 166.¹⁶
1927. *Aeschna multicolor* Seeman, Pomona Coll. Journ. Ent. & Zool. 19: 25.¹⁷

1929. *Aeschna multicolor* Needham & Hayward, Handb. Drgfls. N. Amer. 141.¹⁸
 1932. *Aeschna multicolor* Bird, Pub. Univ. Oklahoma Biol. Surv. iv (2) : 52.¹⁹
 1933. *Aeschna multicolor* McAtee, Ent. News 44: 235.²⁰
 1938. *Aeschna multicolor* LaRivers, Pomona Coll. Journ. Ent. & Zool. 30: 77.²¹
 1948. *Aeschna multicolor* Whitehouse, Trans. Roy. Canad. Inst. 27 (57) : 21.²²
 1955. *Aeschna multicolor* Needham & Westfall, Man. Drgfls. N. Am. 289, 294, 296 fig. C (labial palp, nymph), 297, 308, 309 fig. 188 (apps. ♂).²³
 1891. *Aeschna furcifera* Karsch, Ent. Nachr. XVII: 309.²⁴

Material studied.—WASHINGTON: Sunnyside, C. H. Kennedy, July 14, 1912, 1 ♂, Aug. 1-16, 1913 2 ♂, 1 ♀, id., Bates Pond, Wanita School 1 pair July 14, 1912. CALIFORNIA: Staudinger vd. 2 ♂ Cowley det., coll. Cowley. ARIZONA: artesian pools, St. Davids, Cochise County, Sept. 27, '28, Frank M. Jones 1 ♂, coll. P. P. C. MEXICO: Baja California, Todos Santos Oct. 21, 1912, J. H. Williamson, 1 ♂, UM; Mexico City, L. Conradt 1 ♀, or near thereby, 1915, Roberto Muller donor, 2 ♀, USNM; Michoacan, Tancitaro, alt. 6586 ft., July 16, 1940, taken around a small permanent pool of water 1 ♂, Third Hoogstraal Mexican Biological Expedition, coll. P. P. C. Total 9 ♂, 5 ♀.

Distribution.—British Columbia (Kootenay district⁸ and Victoria, Vancouver's Island⁴) and Washington¹² east²¹ to Sheridan County, Kansas¹⁴ south^{6 7 17} to Michoacan, Toluca¹⁰ and Vera Cruz? (Cordoba¹), Mexico; the Cordoba example may be *jalapensis*.

Altitudinal Range.—Sea level at Victoria, B. C., and 11 ft. at Stockton, California¹⁴ to 6752 ft. (2058 m.) at Williams, Arizona⁷ and 8610 ft. at Toluca, Mexico. The altitudes are according to Gannett, a Dictionary of Altitudes in the United States, 4th edition, 1906, and Monthly Bull. Internat. Bur. Amer. Repubs., Sept., 1904. The localities north of Mexico lie in the Transition to Lower Sonoran faunal divisions and life zones of Merriam (Muesebeck & Krombein, 1952, Syst. Zool. 1:24-25, map). Cf. the altitudinal range given antea page 23 for *Aeschna californica*.

Seasonal Range.—May to September in Central California¹⁴ p. 594. To the few Mexican data given above in the list of material studied may be added Sept. 19 for Toluca.⁹

♂. Pterothorax near pink brown of Smith's Glossary, with pale brown and whitish hairs, a blue antehumeral stripe reaching up almost to the antealar sinus, except in the Tancitaro male, not attaining the anterior mesepisternal margin, diverging downward from its fellow of the opposite side, at mid-height only half as wide as the ground color which separates it from the mid-dorsal

carina and not $\frac{1}{4}$ as wide as that separating it from the humeral suture. Lateral pale stripes blue, reaching to the upper ends of their respective sclerites, almost straight, the mesepimeral stripe of subuniform width, metepimeral stripe widening upward, at its lower end a little, or hardly, narrower than the mesepimeral.

Abdomen with the postmedian dorsal pale spot, PMD, not always represented.

Superior appendages longer than abd. segs. 9 + 10, longer than 8 + 9, in dorsal view subparallel, outer margins nearly straight and parallel in the proximal $\frac{2}{3}$ of their length, thence converging to the acute apex, or at $\frac{2}{3}$ length gently curving mesad and thence in the terminal .17 of their length again straight to the acute apex; profile view as described in the key antea page 12.

Inferior appendage in dorsal view reaching to mid-length of the superiors, triangular, apex $\frac{1}{6}$ as wide as base; in profile view upper margin concave, lower margin convex for entire length of appendage.

Membranule with basal half or less pale, pale bluish along the anal vein, pale reddish along the mesal margin, distal half or more, greyish brown.

♀. Differs from the male as follows: All femora reddish, tuft of hairs on abd. seg. 1 smaller, PMD visible on 3-7, superior appendages lanceolate, margins convex, apex acute, maximum width 1.14 mm. near mid-length.

Dimensions.—Total length ♂ 65 mm., ♀ 64; abdomen (excl. apps.) ♂ 42-44, ♀ 41-45; sup. apps. ♂ 6.14-6.46, ♀ 5.56-5.89; hind wing ♂ 43.5-47, ♀ 44-46, pterostigma, front wing, costal edge ♂ 3.00-3.52, ♀ 3.11-3.93 mm. Front wings with 14-18 antenodals, 8-12 postnodals, hind wings with 9-13 antenodals, 10-14 postnodals.

Ecology. Many data are given for the United States by Kennedy,¹²⁻¹⁵ from which we quote: "This species was observed catching insects on the market street of the city (Sacramento, California) at twilight. They flew among the wagons and buggies entirely indifferent to the numerous passers-by. This habit of familiarity with man's haunts is very noticeable in *multicolor*. It is the most domestic of all the western Odonata" (¹⁴ p. 607). At Golconda, Nevada, on Aug. 7 or 9, he saw "a large Aeshna swarm which was perhaps 200 feet in diameter. Hundreds of Aeshna were evidently feeding on some particular swarm of smaller insects and their numbers made the individuals fearless, so they were easily taken." (Four species of *Aeshna* were taken in this swarm, *constricta*, *interrupta interna*, *multicolor* and *palmata*). *Multicolor* was "very abundant on the sloughs at Stockton, San Joaquin County, California. It is a hot, level country which has been reclaimed by dredging the numerous winding channels of this

river (San Joaquin) and by the building of great dikes along those channels which confine the early summer flood of snow water. . . . These winding, placid streams, brown with mud, are everywhere fringed with green weeping willows, whose drooping branches give to the region the appearance of a languor such as the great humidity and heat produce in the observer."

La Rivers²¹ describes the flight habits of *multicolor* in Nevada.

McAtee²⁰ records the finding of *multicolor* in stomachs of the pigeon hawk (*Falco columbarius*).

From Mr. Harry Hoogstraal, collector of the Tancítaro male, I received a mimeographed statement, "The Rio Tepalcatepec—Cerro Tancítaro Transect of Michoacan, Mexico Prepared to elucidate the investigations of the Hoogstraal Mexican Biological Expeditions—especially for those specialists engaged in the study of specimens collected in the transect." From it are quoted those passages which refer to the altitude, 6586 feet at which the *multicolor* male was obtained. "Northward of Cerro Tancítaro is a great, wide area of confused mountain masses that lie southward of the vast triangular-shaped inland plateau, or mesa central, which occupies the whole central inland region of Mexico . . . Cerro Tancítaro is an outlier of the mountains bordering the plateau, and is at the western end of a short, apparently isolated range running east and west for twenty miles or more. The mountains of this area are a part of the row of recent volcanoes that run along the nineteenth parallel from Colima eastward to Mexico City and which comprise one of the most actively volcanic regions on the continent . . . Tierra Templada The Tancítaro Plateau from Acahuato to Tancítaro and beyond to an elevation of 9000 feet on the slopes of Cerro Tancítaro . . . Open Pine Forest—almost purely temperate (4000 to 7000 ft.). . . . In many places [the Tancítaro plateau] is broken by ridges of volcanic rocks, more or less covered by vegetation. . . . The climate on the plateau is cool the year around with the hottest period in late April and in May and the coldest in December and January, when there may be very light snows. In June and July and early August of 1941 the thermometer once indicated a high temperature of 73° F. but all other temperatures during the daytime were between 59° and 68° F., and from 57° F. to 61° F. during the night. Rain falls almost daily in the rainy reason between June and Mid-October,

often with great force and volume. The rains in the mountain and at the northern end of the plateau, around Tancitaro, are extremely heavy, and this region too is much cloudier than the southern part of the plateau." The male *multicolor* was therefore taken in the rainy season.

- Ae. (Sch.) jalapensis** Tables 1, 3, 5, 7, 10, 13, 16; Pl. XXI; Map 4.
 1908. *Aeshna jalapensis* Williamson, Ent. News xix: 264, 307, fig. (apps. ♂).¹
 1908. *Aeshna jalapensis* Calvert, Ent. News xix: 308.²
 1912. *Aeshna jalapensis* Walker, Univ. Toronto Stud. Biol. Ser. xi: 198.³
 1918. *Aeschna jalapensis* Ris, Arch. Naturgesch. 82 A (9): 167.⁴
 1919. *Aeshna multicolor jalapensis* Calvert, Ent. News xxx: 37.⁵
 1952. *Schizuraeschna jalapensis* Calvert, Ent. News lxiii: 256.⁶
 1905, 1907. *Aeshna multicolor* Calvert, Biol. Centr.-Amer. Neur. 183, 400 (in part).⁷

Material studied.—MEXICO: Jalapa⁷ in Vera Cruz, Sept. 10-12, '06, P. P. Calvert 1 ♂ and Amula⁷ in Guerrero, Aug., H. H. Smith 1 ♂, coll. P. P. C.; Cuernavaca in Morelos, O. W. Barrett ix.'97, 1 ♂ ex coll. C. C. Adams, coll. ANSP. GUATEMALA: San Mateo, 5500 ft., 13.6, 1 ♂, and Volcan Santa Maria, Oct. 31, in Quezaltenango, 1 ♀, Schaus & Barnes, coll. P. P. C. (The San Mateo ♂ was erroneously recorded⁵ as from Santa Maria.); El Fiscal in Dept. Guatemala, June 6, '09, 1 ♀ and Amatitlan, June 7, '09, 2 ♂, E. B. Williamson, E. B. W. det., UM.; San Sebastian in Retalhuleu, Staudinger vd., 3 ♂, 3 ♀, Cowley det., coll. Cowley. COSTA RICA: Laguna Ochomogo, 5000 ft. Sept. 25, '09, 1 ♂, Cartago, May 27, '09, 1 ♂, swamp S. W. of Cartago, June 20, '09, 1 ♂, Cachi, tank in cafetal (coffee plantation), March 9, 1910, 1 ♂, P. P. Calvert, ANSP. Total 13 ♂, 5 ♀.

Distribution.—Jalapa, Mexico to Volcan de Chiriqui, Panama³; 19° 30' to 9° North Latitude, 82° to 100° West Longitude. Also Venezuela if the identification of a larva be correct; see postea.

Altitudinal Range.—4400-6000 ft. in Mexico, 3900-5500 ft. in Guatemala, 5000 ft. in Costa Rica; (1200-1800 m.).

Seasonal Range.—August and September in Mexico, June and October in Guatemala, May to September in Costa Rica. *Ae. jalapensis* is a rainy season species.

♂. Blue of the vertex reduced to two apical spots in the Costa Rican males. Pterothorax vandyke brown or roman sepia (Smith's Glossary), the blue or green antehumeral stripe not reaching to either the dorsal or the ventral mesepisternal margin, the lateral pale stripes a little sinuous, the mesepimeral narrower at mid-height.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, in dorsal view in the proximal half subparallel with the outer (lateral) margins

nearly straight, converging in the distal half to the roundly pointed apex; profile view as in the key, page 12.

Inferior appendage in dorsal view reaching to .4 of the length of the superiors, triangular, apex .22-.36 as wide * as base; in profile view upper margin concave, lower margin convex for entire length of appendage.

Membranule mostly greyish brown, whitish along the anal vein.

♀. Differs from the male as follows: Anal appendages lanceolate, mesal margin a little more convex than the lateral margin, apex roundly acute, maximum width 1.10-1.31 mm. at .6-.7 of appendage length.

Dimensions.—Total length ♂ 61 mm., ♀ 67, abdomen (excl. apps.) ♂ 43-44, ♀ 42-45, sup. apps. ♂ 5.81-6.30, ♀ 5.97-7.04, hind wing ♂ 42-45, ♀ 44-47, pterostigma, front wing, costal edge ♂ 2.62-3.11, ♀ 3.03-3.19 mm. Front wings with 15-19 antenodals, 9-13 postnodals, hind wings with 9-12 antenodals, 11-15 postnodals.

Living colors.—The envelope containing one of the Amatitlan males bears the following in E. B. Williamson's handwriting: "Taken along river at its beginning at lake about 6.20 P. M.—twilight. Eyes blue. Thoracic stripes green, very narrow, antehumerals $\frac{1}{2}$ length of thoracic segment, very narrow and pointed. Abdominal markings very small, blue anteriorly, green posteriorly, absent on 9, almost wanting on 8, about equal on 4-7, very small on all."

I made the following description of the colors of the Cachi male the day after capture when they apparently had not faded much: "Eyes dark blue above, paler below with a faint greenish tinge, dark and paler blues separated distinctly as shown by this sketch of right eye in profile view (sketch shows a zigzag line). Face, lips, small spots at wing-bases, pale markings on sides of abd. segs. 2 and 3 (except as noted below) bright blue, also upper end of the otherwise green metepimeral stripe. Antehumeral (1.5 mm. long, very narrow), mesepimeral (.5 mm. wide) and metepimeral (.7 mm. wide) stripes, except the upper end of this last, a transverse lateral line at hind end of abd. seg. 1, a minute spot on 2 in front of each auricle, and all the pale dorsal markings on 4-8 green.

Ae. (Sch.) dugesi

Tables 1, 3, 5, 7, 10, 13, 16; Pl. XV; Map 4.

1905. *Aeshna dugesi* Calvert, Biol. Centr.-Amer. Neur.: 180, 184, pl. VIII, figs. 11, 12 (apps. ♂).¹

1908. *Aeshna dugesi* Martin, Colls. Zool. Selys-Longch. fasc. 18: 49, fig. 46 (apps. ♂).²

1930. *Aeshna dugesi* E. B. & J. H. Williamson, Occas. Papers Mus. Zool. Univ. Mich. 216, p. 7.³

1932. *Aeshna dugesi* Gloyd, Ent. News 43: 189.⁴

1955. *Aeshna dugesi* Needham & Westfall, Man. Drgfls. N. Am., 289, 294, 303, 308, 309, fig. 184 (apps. ♂).⁵

* Shown a little too narrow in our figure 274, pl. XXI.

Material studied.—Texas, Davis Mts., June 25, 1931, L. K. Gloyd, 1 ♂, 1 ♀ UM.

Distribution.—TEXAS: Jeff Davis County³ as above; MEXICO: Los Parres in Baja California.^{3 4} Guanajuato.¹

Altitudinal Range.—About 4900 ft. (1494 m.) (Fort Davis in the Davis Mts., Texas), 6750 ft. (2057 m.) at Guanajuato; altitudes according to Gannett, Monthly Bull. Intern. Bur. Amer. Repubs. Sept. 1904, p. 15.

Seasonal Range.—June 25 in the Davis Mts., October 6 & 7 at Los Parres.³

♂. The pale blue bordering the black stem of the T-spot of the frons is continued as a line between the darker greyish blue and the black of the eye margin of frons and clypeus.

Blue antehumeral stripe with its lower end pointed, at mid-height nearly $\frac{2}{3}$ as wide as the ground color which separates it from the mid-dorsal carina and $\frac{1}{3}$ as wide as that separating it from the humeral suture. Lateral pale thoracic stripes blue, almost straight, of subuniform width, the metepimeral hardly narrower at its lower end.

Abdominal segment 1 with the tuft of hair smaller than in *multicolor*. PMD pale spot not evident; isolated blue spots at the hind end of the inflexed tergite of segs. 4-7 not visible.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, in dorsal view, in the proximal half of their length subparallel, their lateral margins nearly straight and parallel but in the distal half converging to the almost squarely truncated apex; profile view as given in the key, antea, page 12.

Inferior appendage in dorsal view reaching to .44 of the length of the superiors, triangular, apex .16 as wide as the base; in profile view upper margin concave, lower margin convex for entire length.

Membranule: basal half white, distal half greyish brown.

♀. Differs from the male as follows: Tibiae dark indian red, sternum of abd. seg. 10 with about 80 black spinules of different lengths up to .12 mm., arranged in roughly five transverse rows, the longer spinules in the hinder rows.

Dimensions.—Total length ♂ 64 mm., abdomen (excl. apps.) ♂ 47, ♀ 47, sup. apps. ♂ 5.97, ♀ 5.97, hind wing ♂ 46, ♀ 50, pterostigma, front wing, costal edge ♂ 2.49, ♀ 3.35 mm.

Ecology.—*Ae. dugesi* was taken by J. H. Williamson at Los Parres in Baja California in the same locality with *Ae. (Hesperaeschna) manni*; his description of the locality has been quoted under the latter species, antea, page 58.

Discussion.—*Ac. dugesi* was named for the collector of the type specimen, Prof. Alfredo Duges (1826-1910) who came from France and became professor of natural history in the Colegio del Estado at Guanajuato.*

Subgenus **Marmaraeschna**

1952. *Marmaraeschna* Calvert, Ent. News 63: 256 (generotype *Ac. intricata* Martin, 1908.

Diagnosis.—Abdominal segment 1 with a ventral tubercle bearing spinules or hairs or both, supratrangular cross-vein(s) present, pterothorax with scattered black or brown marks, point of beginning of two rows of cells between M1 and M2 proximal to the stigma or under the proximal end, or proximal half of the stigma; males with a mid-dorsal longitudinal carina on abd. seg. 10, superior appendages in lateral edge view not bifid apically, hind wings with anal triangle 3-celled.

A key to the species is given antea, pages 13, 14. The species run very close together; they are here differentiated chiefly by the superior appendages of the males; the females are associated with the males on the basis of a common locality.

Description of additional features common to the following species of this subgenus and not repeated in the specific descriptions. Face clouded with grey blue (♂), frons superiorly blue, yellow on the sides (♂), dull olive grey (♀), fronto-clypeal suture with a pale brown to black line margined above on the frons by a wider yellow stripe, in some also below on the clypeus by a similar yellow stripe, occiput pale above, rear of eyes black. Labrum bluish (♂), yellow in the center (♀).

Pterothorax pale bluish with fine hairs, its black or brown spots differing according to species, no pale lateral stripes. Legs black, upper surfaces of femora and of tibiae pale green or yellow.

Abdomen with a tuft of pale hairs on each side of dorsum of segment 1; markings of seg. 2 as shown in our plates IV, XX and XXXVII, but not specifically different; ground color of abdomen brown basally to black apically and the following black: transverse denticulated apical carina on 2-9 or -10, the transverse antemedian carina on 2- or 3-7, much of the mid-dorsal longitudinal carina on 3-9; the following pale marks blue or green: MD on 3-8, a larger PD on 3 or 4-5 or -6 or -7 or -8 or -9, confluent with PL, most of 10, AL, ML and PL on 1-6 or -7 or -8.

* Maldonado-Koerdell, M. Las colecciones de anfibios del Museo Alfredo Duges en la Universidad de Guanajuato. I. Urodeles. Mem. Rev. Acad. Nacion. Cienc. "Antonio Alzate" 56 (2/3): 185-226, illust., 1948. A portrait of Duges is in Revist So. Mex. Hist. Nat. 12: 85, Mexico, D F., Diciembre, 1951.

Males with the auricles of seg. 2 each normally with two acute teeth on the hind margin; anterior lamina cleft posteriorly for much of its length, its spines reaching caudad not as far as the level of the hind end of the hamular processes; antero-mesal angle of hamular processes acute, the postero-mesal angles rounded, diverging; hind angles of hamular folds rounded, diverging; anterior end of sheath of penis acutely pointed, hind end truncately rounded; genital lobe finely denticulated posteriorly; superior appendages with a subbasal, ventral tubercle or tooth.

Females: ovipositor and genital valves reaching caudad beyond the level of the hind end of the tergum of 9, palps of the valves with a terminal pencil of pale hairs; lateral genital plates reaching to, or not as far as, the half-length of the tergum of 9; basal genital plates with their hind margins in, or nearly in, the same transverse straight line, or each plate a little convex posteriorly; sternum of 10 with numerous black spinules.

Venation brown or black, costa paler to nodus or beyond, stigma surmounting usually 2- cells.

Ae. (M.) brevifrons Tables 2, 4, 5, 7, 11, 13, 16; Pl. IV; Map 5.

1861. *Aeschna brevifrons* Hagen, Syn. Neur. N. Amer. 129.¹

1875. *Aeschna brevifrons* Hagen, Proc. Boston Soc. Nat. Hist. xviii: 36, 39.²

1905. *Aeshna brevifrons* Calvert, Biol. Centr.-Amer. Neur. 181, 186.³

1908. *Aeschna brevifrons* Martin, Colls. Zool. Selys-Longchps. Cat. Syst. Descr. fasc. XVIII: 58, fig. 54 (apps. ♂).⁴

1909. *Aeschna brevifrons* Foerster, Jahrb. Nassau. Ver. Naturk. Wiesbaden 82: 217.⁵

1952. *Aeschna brevifrons* Schmidt, Beitrage Fauna Perus Hamburg. Südperu. Exped.: 238.⁶

1952. *Marmaraeschna brevifrons* Calvert, Ent. News 63: 256.⁷

1953. *Aeshna brevifrons* Racenis, Anales Univ. Centr. Venez. 35: 38.⁸

Material studied.—MEXICO: Acapulco 1 ♂ MCZ. PERU: Lima, Dr. P. Martin 1 ♂ no. 5469, det. Cowley, coll. Cowley; Matucana, Dept. Lima, May 26, 27, 1920, J. H. Williamson 6 ♂, 2 ♀ UM; Sachabamba, Süd-Peru, 1700 m., 6.14.1936, 1 ♀ no. 455, coll. Schmidt ex dupls. Mus. Hamb.; Arequipa, Dec. 19, 1877, A. Agassiz 1 ♀ MCZ, Oct. 28, 1898, W. J. Gerhart, 1 ♂ ANSP. CHILE: Socoroma, 2.3.48, 1 ♂, Putie, 25.2.48, 1 ♂, Mini-Mini, 18.2.48, 1 ♀, Taltal, 20.1.1942, coll. Javar, 1 ♂ coll. Cornell Univ. sent by Prof. J. G. Needham; Poronea, 10.3.48, 1 ♂, Valparaiso 1 ♀ allotype MCZ, Santiago, 24.5.48, S. Barros Vallenuela 1 ♀, coll. Lieftinck. Total 13 ♂, 7 ♀.

Distribution.—Acapulco, Mexico, to Venezuela,⁸ Peru, Santiago, Chile, and Sapucay, Paraguay,⁵ 17° North Lat. to 34° South Lat., 70° to 100° West Long.

Altitudinal Range.—Sea level at Acapulco to 4025 m. (13205 ft.) at Tayapampa in Dept. Ayacucho, Peru.⁶

Seasonal Range.—South of the Equator October to May. *Ae. brevifrons* is a dry season species.

♂. Frons rugulose anteriorly, clypeus more finely so. Black stem of the T-spot on the upper surface of frons complete or interrupted in mid-length so as to be represented by a basal (posterior) conical, semi-elliptical or circular spot and an anterior top on the transverse carina; pale blue on each side of the stem, followed laterad by a greyish infuscation; pale blue running ventrad on sides of frons and clypeus but separated from eye margin by a black stripe which is continued from the base of the stem in front of the vertex; a tuft of greyish hairs on each side of frons and of clypeus; vertex blue.

Prothorax from dark violet carmine (Smith's Glossary) through neutral to brown, some long white hairs on the lateral margins of the hind lobe.

Pterothorax probably blue in life, much of the surface with fine white or dark hairs, the following blackish: much of the mid-dorsal carina, a line on the humeral suture, sutures between the mesepimeron and mesinfraepisternum, between metepisternum and metinfraepisternum, between metepimeron and metinfraepisternum, a line on the lower part of the otherwise obsolete first lateral (interpleural) suture and on the second lateral suture, the margins of the metastigma and a small spot above and adjoining it, a transverse band on the anterior margin of the mesepisterna, on the articulation between the metinfraepisternum and the third coxa, a curved stripe on the upper margin of the metepisternum, and a stripe in the articulation between the metathorax and the first abdominal segment; pectus obscure. A pale yellow or greenish antehumeral stripe .74-.90 mm. wide at its upper end, which does not attain the antealar sinus (not shown in our fig. 45, pl. IV).

Abdominal segment 7 similar to 6 except that AD and AL are usually not confluent, on 8 AD is present or absent, on 9 only PD and PL are present, most of 10 pale corresponding to PD and PL which are confluent. Auricles of seg. 2 with a third, rudimentary, distal tooth in the Soconoma, (right auricle only) and the Povonea (both auricles) males. Denticles on the genital lobe 10-30.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, in dorsal view diverging in the basal fourth, thence converging to the acute apex, lateral margin distinctly less convex than the mesal margin, maximum width .71-.90 mm. at .54-.62 of appendage length, a low, longitudinal, superior, rounded carina visible near the hind end of the appendage (not visible in profile or edge views); the apex ends in an acute spine which is more nearly in line with the lateral than with the mesal margin. In edge view the mesal margin is not visible, in profile view it forms the lower margin of the appendage; an elongated, low, inferior swelling, reaching its maximum at $\frac{1}{4}$ the appendage length, thence decreasing gradually caudad. Under surface shallowly and

widely sulcate, mesal margin thicker in the basal half. The superior carina is visible in edge view as a low ridge in hind .46 of appendage length in one male from Matucana, in two others from Matucana, the terminal spine is a little longer (.16 mm., .2 mm.) and curved a little mesad.

Inferior appendage reaching to .53-.6 of length of superiors, in dorsal view triangular, apex .12-.18 as wide as base, in profile view upper margin concave, lower margin convex for entire appendage length, apex ending in two upturned denticles.

Wings uncolored or slightly smoky, venation dark brown, costa to nodus, subcosta and antenodals paler; stigma above varying from burnt sienna, to vandyke brown, to brown ochre, to pale clay yellow, below from cadmium yellow to gamboge to pale clay yellow; membranule whitish in basal half or less, greyish brown in distal half or more.

♀. Differs from the male as follows: Pale antehumeral stripe .61-.98 mm. wide at its upper end. Genitalia of the 8th and 9th abdominal segments as described for the subgenus *antea*, page 109. Anal appendages shorter than segs. 9 + 10, lanceolate, straighter and with a more rounded apex than in the male, maximum width .49-.64 at .5-.65 of appendage length, margins thickened, a low, submedian, longitudinal, superior carina; the apex of the appendages of the Sachabamba female approaches that of the male in acuteness.

Dimensions.—Total length ♂ 63 mm., ♀ 60, abdomen (excl. apps.) ♂ 40.5-46, ♀ 40-45, sup. apps. ♂ 4.58-5.24, ♀ 1.47-2.78, hind wing ♂ 43-46, ♀ 43-47, pterostigma, front wing, costal edge ♂ 2.13-2.76, ♀ 2.37-2.86 mm. Front wings with 11-15 antenodals, 9-14 postnodals, hind wings with 8-9 antenodals, 11-14 postnodals.

Discussion.—Schmidt⁶ places *intricata* Martin and *vigintipunctata* Ris as synonyms of *brevifrons* Hagen. Foerster⁵ makes *intricata* a race of *brevifrons*; our key, *antea*, page 13 indicates our method of separating these three. I can find no evidence for Martin's statement⁴ that the type of *brevifrons* is in the Museum of Vienna; surely the type is the Acapulco male in the MCZ.

Ae. (M.) intricata Tables 2, 5, 7, 11, 13, 16; Pl. XX, Pl. XXXVI, figs. 480-482, Pl. XXXVII, figs. 490, 494-499; Map 5.

1908. *Aeschna intricata* Martin, Colls. Zool. Selys-Longchps. Cat. Syst. Dseer. fasc. XVIII: 59, fig. 55 (apps. ♂).¹

1909. *Aeschna intricata* Foerster, Jahrb. Nassau. Ver. Naturk. Wiesbaden 62: 217 (race of *brevifrons* Hagen).²

1952. *Aeschna intricata* Schmidt, Beitrage Fauna Peru Hamb. Süd-Peru. Exped. III: 238 (synonym of *brevifrons* Hagen).³

1952. *Marmaraeschna intricata* Calvert, Ent. News 63: 256.⁴

1953. *Aeschna intricata* Racenis, Anales Univ. Centr. Venez. 35: 37.⁵

Material studied.—COLOMBIA: Choachi, July 15 1 ♂, 1 ♀, and Susumuco, November, 1916, 1 ♂, 1 ♀ coll. D. C. Geijskes. ECUADOR: Puenbo, 1 ♀, Quito, 1 ♀, F. Campos R., nos. 7 and 40, coll. P. P. C.; Rio Blanco, 1700 m., May and July, 1939, 1 ♂, 1 ♀, 1800 m., 15.i and 10.v., '39, 1 ♂, 1 ♀, 20.vii. '39, 1 ♀, 1900 m., 27.xi.'37, 1 ♀, 2000 m., v.'36, 1 ♀, Rio Pastaza watershed, 5.x.'36, 1 ♀, Baños, 1900 m., x.'37, 1 ♂, brook into Rio Blanco 12 km. E. of Baños, 1700 m., 9.iv.'36, 1 ♂, La Merced, 1300 m., iv.'36, 1 ♀, Guama Yacu near Agoyan, 3000 m., 9.v.'36, 1 ♂, W. Clarke-MacIntyre, coll. C. H. Kennedy; Pallatanga, F. Campos R., nos. 62, 63, 2 ♂, no. 64 1 ♀, Guasuntos, F. Campos R., 1 ♀, coll. P. P. C. PERU: vicinity of Chachapoyas, Dept. Amazonas, 2000 m., 8 & 24.viii.'36, 1 ♂, 1 ♀, over a pool while flying, 40 km. W. of Chachapoyas, in high mts., vicinity of Leimebamba, 3000 m., 1.i.'37 1 ♂, vicinity of Celendin, Dept. Cajamarca, 2625 m., 29.v.-11.vi.'36, 3 ♂, 3 ♀, F. Woytkowski, UM; Huacapistana, 1.vi.1920, 1 ♂, 1 ♀, Tarma, 30 & 31, '20 1 ♂, 3 ♀, J. H. Williamson (also J. C. Bradley at Tarma), UM; Querebamba, 3520 m., 17.iv.'36, Hamb. Süd-Peru Exped., 1 ♂ no. 442, coll. E. Schmidt ex dupls. Mus. Hamb.; vicinity of Concepción, 3400 m., 7-8, 25-29.iv.'35, 1 ♂ 3 ♀, F. Woytkowski, UM; La Merced, Chanchamayo, Dr. P. Martin, 1 ♀ det. Cowley no. 5470, coll. Cowley; Huanta, Prov. Huanta, Dept. Ayacucho, 1.iii.1941, F. Woytkowski, 1 ♀ Coll. Kennedy. CHILE: Putre, 25.ii.'48, 1 ♂ coll. Cornell Univ. sent by Prof. J. G. Needham; Camino a Farellones, ± 1200 m., 5 & 8. xii.1948, 4 ♂, 1 ♀, coll. Lieftinck. Total 23 ♂, 27 ♀.

Distribution.—Mexico to Chile and Brazil.¹

Altitudinal Range.—In Ecuador 1300-3000 m., in Peru 2000-3520 m., in Chile about 1200 m., extremes 1200-3520 m. (3937-11547 ft.). In Ecuador *intricata* occurs in the Tropical, Subtropical and Temperate Life Zones of Chapman (1926) as summarized by Brown* based on the bird life, in the Interandine Subtropical and Temperate Natural Regions of Acosta Solis.† These represent a mean annual temperature range of 3° to above 23° C. (37°-73° F.), and a rainfall of 500-800 mm. annually. At Quito June to August are the dry season, September to May the rainy season; ‡ if this holds for the Rio Blanco at 1700-2000 m., *intricata* has been taken there in both seasons. The localities for *intricata* in Peru lie in the Yunga Fluvial, Quechua and Suni Regions of Pulgar Vidal § and the North-Eastern, North Central

* Ann. Ent. Soc. Amer. 34 (4): 810, 1941.

† Flora 4 (11/12): 140, 201-202, Quito, 1944.

‡ Kendrew, W. G., *Climates of the Continents*, p. 319, Oxford, Clarendon Press, 2nd edit., 1927.

§ Bol. Mus. Hist. Nat. "Javier Prado", Lima, 1941, 5 (2): 150.

and Central zoogeographical provinces of Eigenmann and Allen.*

Seasonal Range.—At Rio Blanco and Baños, Ecuador, November to July, also October (see above), at the Peruvian localities collectively January to June and August.

♂. Black stem of the T-spot on the upper surface of the frons complete (Camino à Farellones, Choachi), or interrupted in mid-length so as to be represented at base (posteriorly) by a subcircular or conical spot and anteriorly by a stripe on the anterior transverse carina of the frons (Tarma), or the stripe on the anterior transverse carina absent (Querobamba), each side of the black stem bordered with pale blue or pale yellow narrower than the stem, this followed laterad by greyish blue, and this in turn by pale blue or yellowish which reaches down on to the sides of frons and of clypeus; face bluish (in a male from Camino à Farellones with some admixture of pink) or lavender, labrum in some yellowish in the middle.

Pterothorax, in addition to black lines on the sutures as found in *brevifrons*, with the following brown or black spots: an oval spot on the mesepisternum in front of and adjoining the humeral suture shortly below its upper end, two on the mesepimeron, one at its antero-inferior angle, one more or less U-shaped at about two-thirds height, one sometimes V-shaped at the upper two-thirds of the metepisternum, and two or three, one above another on the metepimeron, upper margins of these dark spots bordered with yellow spots, a pale yellow or green antehumeral stripe, .31-.94 mm. wide, which does not attain the antealar sinus.

Pale markings on abdominal segments: Antero-dorsal AD present on 8, on 9 only PD and PL are present and are confluent. Most of 10 is pale, gamboge, cadmium yellow or clay yellow. The mid-dorsal longitudinal black or dark brown stripe separates the right and left PD from each other on 3-5 or -6.

Superior appendages subequal in length to abdominal segments 9 + 10, in dorsal view with the lateral margin distinctly less convex than the mesal margin, maximum width .76 (Putre)-1.23 (Chachapoyas, Huacapistana) mm. at .75-.78 of appendage length, a low, rounded, longitudinal carina visible near the hind end of the appendage and also visible in profile view,¹ fig. 55, and our fig. 258, pl. XX, apex rather abruptly pointed, especially on the mesal margin, terminal spine .05-.16 mm. long, in line with the lateral margin, except in a Pallatanga male; edge view as stated in the key, page 13, the arched, superior, longitudinal carina .07-.20 mm. high,† the mesal margin showing as an inferior

* Fishes of Western South America, University of Kentucky, Lexington, Ky., pp. 40-41, 1942.

† The height of the superior carina of the superior appendages is measured from the upper edge of the lateral margin; in Martin's fig. 55 the height is .118 mm. measured under the binocular microscope, oculars 4, objectives a.

convexity .08-.19 mm. high in the terminal third of appendage length. Under surface sulcate, a submedian longitudinal carina from the subbasal tooth to .6 or more of appendage length.

Inferior appendage reaching to beyond the level of half-length of the superiors, triangular in dorsal or ventral view, its apex .31 (Putre) to .22 (Querobamba) as wide as the base.

Wings uncolored or, less frequently, smoky (Guama Yacu) or slightly smoky (Baños, Pallatanga), venation generally blackish, but costa a paler or darker brown to, or almost to, the nodus or beyond, antenodals of one or of both series pale; ante- and post-nodals margined with brown (Guama Yacu). Stigma varying above from blackish brown through cologne earth, roman sepia, indian red and pale brown to between cadmium yellow and pale brown, below from vandyke brown to indian red and pale brown. Membranule varying from the basal half (a) or less than the basal half (b) white to the base very narrowly white (c), in all three cases the remainder being brownish grey; the sexes are similar in one and the same locality; the same one of these three conditions occurs in localities as widely separated as Choachi and Querobamba (a) or Pallatanga and Camino à Farellones (c).

♀. Differs from the male as follows: Frons blue, paler on the sides (Tarma), or violet carmine (Smith's Glossary) anteriorly, pale clay yellow on the sides (Susumuco, Concepcion, Camino à Farellones), or lilac, pale clay yellow on margins (Concepcion). Clypeus violet carmine (Concepcion, Camino à Farellones), or pale blue (Choachi), or lilac, pale clay yellow inferiorly (Concepcion). Black T-spot of frons represented by a circular or semi-elliptical basal spot prolonged (Susumuco, Camino à Farellones), or not prolonged (Tarma, Concepcion), forward to the anterior transverse carina of the frons, which carina is black (Susumuco, Quito), or black in the middle and pale bluish or yellowish each side (Tarma), not extending down to the fronto-clypeal suture. The anterior carina of the frons in front view is doubly arcuate in one Tarma female, but not so pronounced in the other two or in a female from Concepcion. Labrum bluish, yellow in the center (Tarma, Camino à Farellones), or yellowish (Choachi), or clay yellow (Susumuco). Labium colored as the labrum, or obscure neuter (Choachi), or pale violet carmine (Camino à Farellones), or lilac (Concepcion). Vertex pale gamboge (Susumuco), or bluish (Tarma, Camino à Farellones). A black stripe along eye-margins and enveloping the median ocellus where it is confluent with the base of the T-spot.

A T-shaped pale chrome yellow antehumeral stripe, top of T 1.64 mm., stem of T .41 mm. wide, top of T prolonged as a yellow line or stripe to humeral suture by an additional 1.55 mm., or the top of the T absent, only the stem present (Puembo), or the top of the T prolonged .74 mm. to the mid-dorsal carina in a Tarma female; below the prolongation to the humeral suture is another parallel yellow stripe in at least one Tarma female.

Dark markings on abdominal segment 1 consist of a pair of spots on the anterior half (Susumuco) or entire length (Tarma, Concepción), not confluent (Choachi, Susumuco, Tarma, Concepción, Camino à Farellones); on segment 2 a transverse stripe on the ante-median transverse carina, a transverse stripe each side anterior to, and either separated from (Tarma, Concepción) or narrowly connected with (Choachi, Susumuco, Concepción, Camino à Farellones) the carinal stripe; on 3-7 or -8 margins of the transversely elongated pale MD and the mid-dorsal longitudinal black which separates the two PD from each other but not on 8 (Tarma, Concepción). In dorsal view pale colors predominate over dark on 1-6, the dark prevail on 7-9. Segment 10 chiefly blue, an anterior transverse black stripe or spot and a black spot opposite each appendage (Susumuco, Tarma), or the hind margin black (Choachi, Tarma, Concepción).

The anal appendages vary in length from 1.50 to 6.30 mm., the maximum width from .65 to 1.47 mm. at .47 to .70 of the appendage length; their shapes are shown in pl. XX, fig. 271-2, and pl. XXXVI, figs. 480-482; their sizes seem not to be correlated with geographical locality. The longest examples in the present material are those of the female from Chachapoyas 6.23 mm., abdomen excluding appendages 49 mm., and of the female from Huacapistana, 6.30 mm., abdomen excluding the appendages 50 mm.

The wings are slightly smoky in the females from Choachi, Quito, Tarma and Huanta. The stigma above varies from roman sepia through indian red, between cadmium yellow and pale brown to clay yellow, and below from brown to pale brown and pale clay yellow; the color in males and females from the same locality may be different (Susumuco ♂ blackish brown above, vandyke brown below, ♀ clay yellow above, paler below) or the same (Choachi ♂ ♀ roman sepia above, pale brown below); the colors seem not to be correlated with geographical locality, thus the Susumuco ♀ and the Tarma and Quero-bamba males have the stigmata similarly colored.

Dimensions.—Total length ♂ 70 mm. and less, ♀ 63 mm. and less. Abdomen (excl. apps.) ♂ 35-48, ♀ 36-50, sup. apps. ♂ 3.11-5.65, ♀ 1.50-6.50, hind wing ♂ 38-48, ♀ 41-52, pterostigma, front wing, costal edge ♂ 1.88-2.86, ♀ 2.13-2.03 mm. Front wings with 10-15 antenodals, 10-13 postnodals, hind wings with 7-10 antenodals, 7-13 postnodals.

Ecology.—The following notes on the envelopes of the Peruvian specimens are by the collector, Mr. Woytkowski: Leimebamba ♂ "Rare!"; Celendin, ♀, June 3, 1936, "This species has been taken sitting on the wall of a rock some 300 m. higher in the mountains east of Celendin (= 2925 m. a. s. l.) far from any water. This is a new species from the higher Andes, as it lacks the 2 greenish-yellow stripes on the sides of the protorax. Rare & difficult to get." Celendin ♂ June 4, 1936, "Now this species has been taken higher upon hills—far

from any water—sitting on the wall of a rock (this alighting there I consider characteristic for this insect!?). Whereas the ♀ (?) marked No O 30 has no blue (pronounced) at all, this insect has all along its body on both sides blue stains which nearing the protorax below the body becomes crying, vivid blue.” Celendin ♀, June 4, 1936, “No. O 30 A most perplexing problem is this genus. The insect in this folder has been taken sitting upon the floating leaf of a water plant close to shore in the following way: Two large dragonflies with vivid blue markings were flying to and fro over the spot where the enclosed spec. was sitting; all at once one of them alighted upon the sitting one on the leaf and they were [about] to rise, when I caught them. This spec. has no one blue dot upon its whole body, only olive yellow with reddish and greenish (may be dirty blue) tints and black markings. It lacks the two oblique stripes of yellow green on the sides of the protorax. To pick out readily this pair I have given both folders the red stamp and marked the folders No. O 30.” “Celendin ♀, June 9, 1936, The puzzle about this species continues: I took it just before sunset, flying low to and fro over a tiny boggy stream full of vegetation. I thought it lived merely higher up in hills.” Celendin ♀, June 10, 1936, “The Indian boy who carries my nets, etc., brought to me this morning this insect,—says it was sitting upon the wall of a house.” Chachapoyas ♂, Ago. 8, 1936, “#888. A mating pair taken over a brook in wooded hills. The male seems different from specimens I took in Celedin, as the blue underneath the thorax is unusually brilliant and vivid. All Odonata are scarce around Chachapoyas.”

Discussion.—It is evident that in the three places where Mr. Woytkowski uses “protorax” the pterothorax is meant. He notices the absence of the two oblique greenish yellow or yellow green stripes on the sides of the “protorax” in this species, a feature which we have mentioned, antea, page 109, as characteristic of the subgenus *Marmaraeschna*, in contrast to their presence in *Hesperaeschna*, page 21, and in *Schizuraeschna*, page 101.

Martin¹ called attention to the great variability of the anal appendages of the female in this species.

Martin¹ wrote of *intricata*: “Types. Coll. Selys et R. Martin” and figured the appendages from a male in “Coll. Martin”.

At my request, Dr. Erich Schmidt kindly examined the material of this species in both of these collections and wrote in English concerning them as follows: "Paris, June 24, 1951. The specimens which I found, only three, are in another cast of 'Collection R. Martin'. The specimens are all damaged; they are labelled as follows: No. 1 ♀ juvenile, without abdomen, ex larva, 'Perou', the larva was not there.—No. 2 ♂ ad., colours good, 'Bolivie' end of abdomen missing.—No. 3 ♂ thorax damaged, without head and abdomen 'Perou'. All specimens have the name label in Martin's hand. The drawing of pattern of thorax [here reproduced as our figure 261, plate XX] was made from No. 2. It should not be overlooked that Martin has written 'Types Coll. Selys et R. Martin,' The labels in coll. R. Martin have not designation 'type'. My opinion is that the real type is in Coll. Selys. As I shall come to Brussels Museum I shall ask there for the specimens. My impression (perhaps superficial!) is that the specimens in Martin collection and that those of my own collection (Peru) now in your hands are the same species." Dr. Schmidt wrote from Bonn, July 10, 1951, "Brussels: In 'collection generale' *Ae. intricata* there are nine specimens, all with red type labels, 2 males juvenile, and 7 females (2 juvenile, 5 adults). I have measured the adults No. 1 female adult 'Ecuad. Esmer.' green label abd. 46, hind wing 48. No. 2 female adult 'Sigura Ecuad'. abd. 46, hind wing 47.5 mm. No. 3 female adult 'Cauca Columb. abd. 47, hind wing 49.5. No. 4 female juvenile 'Imbabura (?) Ecuad'. No. 5 male juv. with same label as no. 4. No. 6 female juvenile 'Nanegal Ecuad. No. 7 female adult (without head) 'bahia (blue label) abd. 48, hind wing 51.7 mm. No. 8 female adult 'Sigura Ecuad.' (green label) abd. 46, hind wing 48 mm. No. 9 male juvenile 'Venezuela Dr. Habuel' (printed) (Green label).^{*} Now (June 28, 1951) I suppose that the type (holotype) will best be elected among Paris specimens, and No. 2 male, there, incomplete,

^{*} On quoting specimens from deSelys' collection in the *Biol. Centr.-Amer. Neur.*, pp. 84-85, bearing the label Venezuela Dr. Habuel, the Editor suggested that by "Habuel" was meant "Hahnel, a well-known traveller in South America." Thanks to Miss Mary Pearsall, of the Library of the Academy of Natural Sciences of Philadelphia, I have seen an obituary notice of Dr. Paul Hahnel by Dr. Otto Staudinger in the *Deutsche Entom. Zeitschr.* Iris 3: 128-132, 1890, and Dr. Hahnel's "Entomologische Erinnerungen an Sud-Amerika" in the same volume, pages 133-332. Dr. Hahnel collected in Venezuela from January, 1877, to near the end of 1879.

seems to me to be most fit. Patterns of thorax may be somewhat different, especially two dark spots over the lateral stigma may be present or not. I do not know differences between *Ae. brevifrons* Hag. and *intricata* Martin. The supratrangular cross-veins of *Ae. intricata* male, in Paris, are front wings R[ight] 2, L[eft] 1; hind wing R 1, L 1; number of vertical rows of cells in anal loop, hind wings R 3, L 3. The later statements most probably concern the number 2, male, in good condition except that the end of abdomen is missing. Measurement of hind wing of male No. 2, Bolivie 41.5 mm."

It may be pointed out that in June, 1951, Dr. Schmidt's opinion was that the holotype of *intricata* was to be selected from specimens in Martin's collection at Paris although they have not the designation "type" and all nine specimens at Brussels bear red type labels.

Ae. (M.) vigintipunctata Tables 2, 5, 7, 11, 13, 17; Pl. XXXVI, figs. 478, 479, 483-487, pl. XXXVII, figs. 488, 489, 491-493; Map 5.

1918. *Aeschna vigintipunctata* Ris, Arch. Naturgesch. 82 Abt. A (9): 163 figs. 107 (thor. patt.), 108 (apps. ♂).¹

1947. *Aeschna vigintipunctata* Fraser, Acta Zool. Lilloana 4: 433, 446.²

1952. *Aeschna vigintipunctata* Schmidt, Beitrag. Fauna Peru 3: 238 (as synonym of *brevifrons*).³

1952. *Marmaraeschna vigintipunctata* Calvert, Ent. News 63: 256.⁴

1875. *Aeschna laticeps* Hagen, Proc. Boston Soc. Nat. Hist. 18: 39 (no description, Cordova, Argentine Republic).⁵

Material studied.—BOLIVIA: Prov. Chapare, Dept. Cochabamba, 11 de 1930, Fr. Steinbach 4 ♂ coll. C. H. Kennedy; Yungas, road to Coroico, April 7, 1899, 1 ♂, 9 miles north east of Coroico, May 23, 1899, 1 ♂, William J. Gerhart, ANSP. ARGENTINA: La Criolla, Tucuman, 1500 m. Janvier, 1903, Baer 1 ♀ Cornell Univ., sent by Prof. Needham, Cordova 1 ♂, MCZ., Ra Salta San Lorenzo, 1400 m., 4 ii '48, Willink-Monros 1 ♂ Mus. Zool. Univ. Tucuman; no locality or date, in envelope similar to that of preceding male, 1 ♀, presumably same Mus. Zool. Total 8 ♂, 2 ♀.

Distribution.—Huancabamba, Peru¹ to Cordoba, Argentina, 5° to 28° South Latitude, 65° to 78° West Longitude.

Altitudinal Range.—400-2400 m. (1312-7315 ft.).

Seasonal Range.—January and February in Argentina, February, April and May in Bolivia. The dated Argentine specimens were taken in the wet season, those from Bolivia in the wet season and near its end.*

* From Reed, W. W., U. S. Year Book Agric. 1941, p. 674, and Kendrew, W. F., *Climates of the Continents*, 2nd edit., pp. 320-322, 330-335, 1930; 4th edit., pp. 487, 508, 525, 526, 1953.

♂. Face bluish, but the frons anteriorly greenish blue in some, or obscure lilac; in the Cordova male brownish, probably discolored, possibly with some mixture of bluish in life. Frons with its anterior transverse carina biarcuate in both dorsal and anterior views; in a Chapare male reddish brown immediately below this carina; a blackish or dark brown stripe bordering the eyes and enclosing the median ocellus where it is confluent with the base of the T-spot; base of T-spot .5 (Cordova) -1.55 (Yungas) mm. wide, narrowing forward to .82 mm. where it joins the head of the T (Yungas, S. S. Lorenzo), or stopping short of reaching the head by its own width (Chapare, Cordova); head of the T 2.62 to 4.09 (Chapare) mm. long, its ends rounded, not acute, or acute (S. S. Lorenzo); stem of T-spot bordered each side by a much narrower pale yellow or greenish stripe, uniform in width (Chapare) or narrower anteriorly (Chapare, Yungas), followed laterad by pale blue, lilac, or bluish brown which reaches down to the fronto-clypeal suture. Labrum pale blue, yellow or lilac, narrowly brown or black along the clypeo-labral suture and usually still more narrowly along the middle of the free margin; a median, fine, black line usually present on the basal half. Labium yellow, pale bluish or lilac. Vertex pale blue or yellow, margined with black, or black with a yellow spot in front of each lateral ocellus. Occiput pale blue or yellow, hind margin slightly concave, posterior surface concolorous with the black or dark brown of the rear of the head, the Cordova male with an ill-defined pale yellow spot at the middle.

Prothorax pale blue or brown, slightly pruinose in the S. S. Lorenzo male, hind margin yellow with a row of brown hairs in the middle, whitish on either side.

Pterothorax pale bluish, the following black or dark brown: mid-dorsal carina (except the bifid upper part in some), humeral and second lateral (metapleural of P. Garman 1917) sutures, each side of the suture between mesepimeron and metinfraepisternum, especially on the lower end of the mesepimeron, suture between metepisternum and metinfraepisternum, the borders of the metastigma, a spot extending upward from the metastigma, a U-shaped spot on the upper half of the mesepimeron (anterior arm of the U absent in some), a V-shaped spot on the upper half of the metepisternum and four spots on the metepimeron; the pterothorax with many white and fewer dark hairs; a pale antehumeral stripe about .5 mm. long.

Coxae and trochanters black and yellow, extreme ends (proximal and distal) of femora and of tibiae, inferior surfaces of second and third femora and of tibiae and all of the tarsi blackish, superior surfaces of femora and of tibiae and inferior surface of first femora pale yellow, second and third femora with a dark superior line.

Abdominal segment 1 pale blue, anterior dorsal half brown, a black or pale brown subcircular spot, .39-.57 mm. in diameter, on each side below mid-height in the anterior half. Dorsum of 2 chiefly pale blue or brown, antemedian transverse carina entirely dark brown, its mid-dorsal portion almost straight, not interrupted by pale, with a slight tendency to form two scallops, convex

anteriorly, one on each side; a subparallel dark stripe in front of the carina and confluent with the carinal stripe near the mid-dorsal line; a shorter, wider, also subparallel, brown stripe behind the carinal stripe, widened at its mesal end which does not reach its fellow of the opposite side by about 1 mm. although the interval between them, while paler than the stripes, is darker than PD; PD separated by the extension caudad of the color of this interval; sides of 2 obscure paler anteriorly than posteriorly.

The dark color of 3-10 is brown, becoming darker posteriorly. Pale spots as follows: AD small, fused on 1, fused or not fused on 2, present on 3-7 or -8, absent or present on 9 and 10; MD fused with PD on 1, fused with PD, ML and PL on 2, present in the usual triangular form on 3-7 or -8, present or absent from 9, absent from 10, PD absent from 1, separated or not separated on 2, larger and separated on 3-7 or -9, more often widely separated on 9 and fused on the posterior part of 10, AL perhaps more often fused with ML and PL on 1, diffuse on 2, confluent with AD on 3, extending caudad to the ante-median transverse carina on 3- or 4- to 5 or -8, absent from 9 and 10; ML fused with PD on 1 and 2, distinct on 3-6 or -8, absent from 9 and 10; PL fused with ML and occupying more than the hind $\frac{3}{4}$ of 1, fused with PD on 2, present and apparently confluent with PD on 3 or 4 to 6 or -8, evanescent or fused with PD on 9, larger on 10.

Auricles of segment 2 with 3 or 2 acute teeth on the hind margin, when 3 the most lateral smallest. Margins of the genital fossa pale yellowish except at the genital lobe. Pale color of the anterior lamina, both lateral and mesal, confined to the hind part, anterior edge of the spines blackish brown for the entire length, spines reaching almost to the level of the hind edge of the hamular processes, mesal and lateral edges of the hamular process straight, nearly converging cephalad to form an antero-mesal angle of 45° or much more acute, mesal margin slightly diverging caudad from its fellow of the opposite side, posterior half of hamular process minutely and densely spinulose, hind margin broadly convex and continued into the hamular fold, sheath of the penis acutely pointed cephalad, transversely rounded caudad.

Superior appendages a little longer than abd. segs. 9 + 10, in dorsal view more (Yungas) or less (Cordova) sinuate on the mesal margin (pl. XXXVI, figs. 484, 479), the lateral margin convex or nearly straight throughout, in dorso-internal view the submedian, longitudinal, superior carina is visible for the entire length of the appendage but less prominent between .25 and .60 of the appendage length, apex minutely pointed (mucronate); maximum width .82-1.31 mm. at .74-.85 of the appendage length, lower surface sulcate from the inferior, subbasal tubercle to apex, and with a low, submedian, longitudinal carina from the same tubercle to three-fourths or more of the appendage length; in edge view the superior carina, visible in the terminal third or fourth of the appendage, is arched to a maximum height of .33-1.64 mm. at the mid-length of the arch, the arch not denticulated, and the mesal margin of the appendage shows as a convexity .08-.19 mm. high, the inferior subbasal tubercle or tooth at

.2-.25 of the appendage length terminating more abruptly caudad than in *brevifrons*.

Inferior appendage reaching to the level of .41-.55 of the length of the superiors, in profile view the upper margin almost straight to concave, the lower margin convex for its entire length, in dorsal or ventral view triangular, sides almost straight, apex .26-.4 as wide as base, with a median notch, ending in two upturned denticles.

Wings uncolored or smoky irrespective of locality, venation blackish except the costa to, or beyond, the nodus and cross-veins between C and R, or M1 + 3, or M4, pale brown; where the wings are smoky the ante- and post-nodals and some other cross-veins are each bordered with brown ochre. Pterostigma surmounting 2-3, rarely 3 +, cells, upper surface varying from cologne earth through roman sepia, dark indian red and dark brown ochre to cadmium yellow, lower surface from brown ochre to clay yellow. Membranule varying from the basal third to extreme base whitish, remainder brownish grey.

♀. Differs from the male as follows: Face violet carmine; frons darker, yellow on the sides down to the frontoclypeal suture, the black T-spot complete, stem and head united, the narrow yellow bordering the stem followed laterad by violet carmine. Labrum clouded gamboge, no black median line. Labium bluish, the base gamboge, or entirely gamboge. Vertex pale blue, margined with black. Pterothorax: bifid upper part of mid-dorsal carina dark brown, anterior arm lacking from the dark U-shaped spot on the upper part of the mesepimeron. Abdominal segment 1 with PD, ML and P1 fused, right and left PD separated, 2 with the subparallel brown stripe behind the antemedian transverse carina faint, PD not separated, confluent with ML and PL, PD fused together on 8, separated on 9; AL present on 5-7 (uncertain on 3 and 4); ML present, not confluent with any other pale spot on 8, PL and PD confluent on 8; PL absent from 9, present and not confluent on 10. Genitalia of 8 and 9 as described for the subgenus, *antea*, page 110. Anal appendages broken off from the La Criolla female, in the unlabeled female 5.73 mm. long, longer than segments 9 + 10, shorter than 8 + 9 + 10, lanceolate, maximum width .98 mm. at 2/3 length, brown, a median, longitudinal, pale yellow line (carina?, thickening?), apex roundly acute. Pterostigma above and below pale cadmium yellow. Membranule brownish grey very narrowly white along the anal vein and along the free margin.

Dimensions.—Total length ♂ 70, ♀ 71 mm. Abdomen (excl. apps.) ♂ 42-54, ♀ 49-52, sup. apps. ♂ 4.43-6.30, ♀ 5.73, hind wing ♂ 43-50, ♀ 50, pterostigma, front wing, costal edge ♂ 2.21-3.11, ♀ 2.70-2.86 mm. Front wings with 11-17 antenodals, 11-15 postnodals, hind wings with 8-10 antenodals, 11-16 postnodals.

Ecology.—Ris¹ quotes Jorgensen as remarking of the male (translated) Not abundant, flies low over the water.

Discussion.—Such differences in the coloring as given here and by Ris¹ are probably due to the more extensive material which I have had before me.

Ae. (M.) pallipes

Map 5.

1947. *Aeschna pallipes* Fraser, Acta Zool. Lilloana, Tucumán, 4: 443, figs. 3a (head), b (last five abd. segs. & apps.) (♀ only, Amaicha, Tucumán, Argentina).¹

I have seen no material of this species.

Distribution.—Known only for the holotype ♀.

Altitudinal Range.—1800 m.¹ (5905 ft.)

Seasonal Range.—February.¹

Discussion.—This species appears to belong to the subgenus *Marmaraeschna* from the data given in the original description¹ and information which I owe to the kindness of Captain Kenneth J. Hayward, who examined the type now in the Dept. of Zoology, Universidad Nacional de Tucumán.

The data given by Col. Fraser are: "IRiii (Rs) forked well before the level of pterostigma, a maximum of 3 rows of cells between the fork and the same between IRiii and Rspl . . . discoidal cells of fore- and hind-wings [with] base more than half the length of distal side, divided up into 4 cells in fore-wings, 3 in the hind; . . . hypertrigones traversed twice in forewings, once in the hind; . . . Abdominal segment 1 has an atrophied ventral tubercle and is coated thickly with coarse greyish hairs".

The information furnished by Captain Hayward is: "The type of *pallipes* F. C. Fraser has a distinct tubercle on the ventral portion of the first abdominal segment, but as stated in the original description it is very atrophied, or what I should personally call atrophied. Compared with *cornigera* it is far less pronounced and I estimate its height to be no more than half the height of the same process in *cornigera*."

"With regard to the thoracic colouring, our only specimen of *diffinis* is unfortunately hollow! For some reason the thorax consists only of the exoskeleton and is completely transparent and shows no colour or markings. On the other hand *pallipes* (the female type) has not in my opinion the two pale lateral stripes. It is discoloured and the pattern is not easy to trace but I should describe it as 'spotted' rather

than consisting of lines. I have asked Dr. Willink, one of my colleagues, to examine it and he came to the same conclusion, that there were no pale lateral lines."

The heights of the ventral tubercle on abd. seg. 1 in 20 species of the genus *Aeshna* are given in our tables 4 and 5; they range from .14 to .7 mm. In *cornigera* the height ranges from .5 to .65 mm., so Capt. Hayward's estimate would make its height in *pallipes* between .25 and .32 mm. In *brevifrons* its height is ♂ .14-.53, ♀ .19-.33 mm., in *intricata* ♂ .16-.49, ♀ .20-.41, in *vigintipunctata* ♂ .24-.33, ♀ .24 mm. The estimated height in *pallipes* therefore falls well within the measurements for the three species of *Marmaraeschna*.

There appear to be several errors in the description and figures of *pallipes*. The pterostigma is stated to be 25 mm., an obvious typographical error, perhaps for 2.5 mm. The description calls for "a pair of small triangular spots on middorsum immediately posterior to jugal sutures on segments 3 to 7." Fig. 3b shows the apical portion of the abdomen from part of segment 6 to the appendages inclusive; the jugal sutures, "transverse sutures found on the basal abdominal segments of many species of Anisopterous dragonflies" (Fraser, Fauna of British India Odonata II: xii), which in the present paper we have called the antemedian transverse accessory sutures, and the small triangular spots are omitted from segment 7 in his figure. His statement "segments 9 and 10 with apical medial and subdorsal rounded and triangular spots", on comparison with his same figure, should evidently read 8 and 9.

The two apical subdorsal spots of 8 and 9 appear to correspond to the postero-dorsal (PD) of Walker's 1912 nomenclature used in the present paper. On segment 7 in Fraser's figure they are shown as much larger than on 8 and 9 and almost confluent with each other except for a slender, middorsal, longitudinal, black line. On 8 and 9 the PD are not confluent with each other but separated by dark coloring which encloses the "apical medial" pale spot. No homologue of this apical medial pale spot is shown on segments 6 and 7. The two "apical subdorsal spots" are shown as confined to the dorsum on 8 and 9, not extending down (ventrad) on the sides of these two segments. In the three species of *Marmaraeschna* which we have ex-

anined PD and PL are often confluent on 8 and 9, but in some *vigintipunctata* males are not confluent.

The pale medial apical spot of segments 8 and 9 in Fraser's fig. 3b seems not to be shown in Walker's 1912 diagram (his figs. 1 and 2, page 9), his plates 22-28, or in his specific descriptions. It is therefore not included in his notation. It is not shown in any of the plates accompanying Martin's Aeschnines, 1911, in the *Genera Insectorum*, nor in his Aeschnines, 1909, in the *Cat. Syst. Descr. Colls. Zool. de Selys-Longchamps*, nor in the colored plate of Charpentier's *Libellulinae Europaeae*, 1840. It would appear that it is confined to the subgenus *Marmaraeschna*.

Ae. pallipes differs from the other three species in having the two pale apical subdorsal spots (PD) on 8 and 9 not continued on to the sides and therefore not confluent with PL and no pale anterior dorsal markings on 9.

Ae. brevifrons differs from the other three species, *pallipes*, *intricata* and *vigintipunctata*, in lacking the apical medial pale spot on 8 and on 9.

Subgenus **Neureclipa**

1911. *Neureclipa* Navas, *Revista Paulista* 8:478 (generotype not specified).¹

1934. *Neureclipa* Cowley, *Entomologist* 67:252. (*Ae. bonariensis* Rambur 1842 fixed as generotype).²

1952. *Neureclipa* Calvert, *Ent. News* 63:257.³

Diagnosis.—Abdominal segment 1 with a ventral tubercle bearing spinules or hairs or both, supratrangular cross-veins absent, pterothorax with two oblique pale lateral stripes, two rows of cells between M1 and M2 beginning under the distal half or distal end of the stigma or distal to the stigma, two vertical rows of cells in the anal loop of the hind wings, males with a mid-dorsal longitudinal carina on abdominal segment 10, superior appendages in lateral edge view not bifid apically but with an inferior subbasal tooth, hind wings with anal triangle 3-celled.

A key to the species is given antea, pages 14-15.

The following features are common to all the species of this subgenus, in addition to those stated in the diagnosis, and are not repeated in the specific descriptions. Stem of the black T-spot of frons bordered each side by a narrower yellow stripe of uniform width or narrower anteriorly, followed laterad by wider greenish-, brownish-, or grayish-blue, a narrow black stripe along the eye-margin. Frons anteriorly rugulose, clypeus less so. Vertex and

occiput pale bluish or yellow, each margined with black. Rear of eyes (post-genae) dragons blood or dark indian red to black. Prothorax brown above, paler brown below, hind lobe bilobed mid-dorsally and with a row of erect whitish hairs 1.5-1.64 mm. high. Pterothorax brown pink, a yellow or blue interalar stripe. Pterostigma surmounting 2- cells.

Males with the auricles of abdominal segment 2 each with two acute teeth on the hind margin, anterior lamina cleft to, or almost to, base, its spines reaching caudad at least as far as the level of the hind margin of the hamular processes, hamular processes with antero-mesal angles acute, their mesal margins diverging caudad; sheath of penis acutely pointed anteriorly, truncated posteriorly, glans penis biblobed for entire length, lobes attingent and rounded laterally to apex.

Females with the ovipositor pale brown, blackish on ventral edges, usually visible for the whole length of the genital valves, reaching to the level of the hind end of the tergum of segment 9. Genital valves luteous, tending to darker along their ventral endges, reaching caudad to, or beyond, the level of the hind edge of the tergum of 9, their palps .5-7 mm. long, with a distal pencil of yellowish hairs. Hind margins of the basal genital plates convergent to the mid-ventral line or each slightly convex in the same transverse line. Lateral genital plates luteous, very close to the inflexed lateral tergal margins of 9, reaching to about mid-length of those margins and to about half the length of the ovipositor and to .24-.62 of the length of the genital valves. Spinulose patch on the venter of segment 10 1.5 mm. wide, subequal in width to the genital valves + the lateral genital plates, not interrupted mesally.

Ae. (N.) diffinis diffinis Tables 2, 8, 11, 13, 17; Pl. XI, figs. 145-152; Map 6.

1842. *Aeschna diffinis* Rambur, Ins. Nevrop. 203.¹

1851. *Aeschna diffinis* Blanchard in Gay, C., Hist. Fis. y Polit. Chile vi:116, lam. 2, fig. 6;² the atlas is dated 1854.

1861. *Aeschna diffinis* Hagen, Synop. Neur. N. Amer.: 314.³

1875. *Aeschna diffinis* Hagen, Proc. Boston Soc. Nat. Hist. 18:38.⁴

1887. *Aeschna diffinis* Porter y Edwards, Rev. Chil. Hist. Nat. 1:13.⁵

1899. *Aeschna diffinis* Porter, Rev. Chil. Hist. Nat. 3:181.⁶

1904. *Aeschna diffinis* Ris, Hamburg. Sammlr. Magalh. Odon. 24, 26.⁷

1908. *Aeshna diffinis* Ris, Deutsch. Ent. Ztsch. 523, 526, figs. 7a, 7b (pattern head & thor., app. ♂).⁸

1913. *Aeschna diffinis* Ris, Mem. Soc. Ent. Belg. 22:84, fig. 24 (venation ♂).⁹

1920. *Aeshna diffinis* Navas, Anales Soc. Cien. Argent. 90:53.¹⁰

1922. *Aeschna diffinis* Campion, Ann. & Mag. Nat. Hist. (9) 10:293.¹¹

1928. *Aeschna diffinis* Joseph, Rev. Chil. Hist. Nat. 32:8, pl. 1.¹²

1928. *Aeschna diffinis* Pirion, Rev. Chil. Hist. Nat. 32: 96.¹³

1928. *Aeshna diffinis* Gazulla y Ruiz, Rev. Chil. Hist. Nat. 32:290.¹⁴

1929. *Aeshna diffinis* Navas, Rev. Chil. Hist. Nat. 33:326.¹⁵

1930. *Aeshna diffinis* Navas, op. cit. 34:350.¹⁶
 1930. *Aeshna diffinis* Navas, Rev. Soc. Ent. Argent. 13:125.¹⁷
 1933. *Aeshna diffinis* Navas, Rev. Acad. Cien. Madrid 29: 54.¹⁸
 1947. *Aeshna diffinis* Fraser, Acta Zool. Lilloana 4:446.¹⁹
 1952. *Neureclipta diffinis* Calvert, Ent. News 63:258.²⁰
 1855. *Aeschna configurata* Hagen, Overs. Dansk. Selsk. Vid. Foerhdl. 1855.
 121 (no description).²¹
 1861. *Aeschna configurata* Hagen, Synop. Neur. N. Amer. 314 (no description).²²
 1875. *Aeschna configurata* Hagen, Proc. Boston Soc. Nat. Hist. 18:39 (synonym of *diffinis*).²³

Material studied.—PERU: vicinity of Concepcion, Andes, 3400 m. April 7, 8, 25-29, 1935, F. Woytkowski, 4 ♂, 1 ♀ UM.; Huanta, Province Huanta, over a mountain brook, Dept. Ayacucho, 28 March, 1941, 1 ♀ F. Woytkowski, coll. C. H. Kennedy; Sachabamba, Süd-Peru, 1700 m., 6.iv.1936, 1 ♂ No. 445, ex duplis. Mus. Hamburg, coll. E. Schmidt. CHILE: ex René Martin, 1 ♂ 1 ♀, coll. P. P. C.; Staudinger vd. 1 ♂ det. Cowley No. 4358, coll. Cowley; Muelle Piedra, Taltal, 8 Enero 1942, 1 ♀, Punta Teatina Serena, 26 ii 1942, 13.11.42, 4 ♂ 3 ♀, Miramar, Coquimbo, 18 & 19.ii.'42, 2 ♂, Javar, coll. Needham, Cornell Univ.; Camino a Farellones, 5 & 8.xii.1948, no collector's name, 1 ♂ 1 ♀, La Reina Tobalaba, no date, no collector's name 3 ♀, Tobalaba, 13.xi and 8.xii. 1948, no collector's name, handwriting on envelopes like that for Camino a Farellones 1 ♂ 7 ♀, coll. Lieftinck, Valparaiso ²¹ 1 ♀ MCZ., Villa Alemana, Province Valparaiso, probably 1921-22, René Martin 9 ♂, 5 ♀ coll. P. P. C., Quilpué, ex coll. R. Martin 1 ♂, coll. P. P. C., Santiago, 23 Oct., 5 & 12, Dic. 1941 R. Cortes 2 ♂ 1 ♀, Nov. 1940, Cervantes 3 ♂ 1 ♀ coll. C. H. Kennedy, Cordillera de Santiago, El Manzanito, 1200 m., 24.x.48, 2 ♂ coll. Lieftinck, Alhué, Province Santiago, 4-5.i and 8.xii.1947, 2 ♂ 1 ♀ S. Barros Valenzuela, coll. Lieftinck, Talca, i.'05 1 ♂ ANSP, Baños de Cauquenes, C. E. Reed 1 ♀ USNM, Linares, 5-21.ii 3 ♂, 2 ♀, 3.iii. 1 ♀, 1-6.iv. 1 ♀, all 1948, S. Barros Valenzuela, coll. Lieftinck, Penco i '05 1 ♂, 1 ♀, Concepción i '05 2 ♂, C. E. Reed, ANSP, Angol, 11 Enero 1942, Miguel Cerdo 1 ♂, 12-15 Nov., 1 & 17 Dec., 1938-1940, D. S. Bullock, 3 ♂, 5 ♀, and Filuca, 8 Feb. 1940, Claudio Puhls coll. from Dr. Bullock 1 ♂, Needham, Cornell Univ. Atlantic slope. ARGENTINA: Humahuaca, 29 Feb. 1920, J. C. Bradley 1 ♀, Villa Angostura, Neuquen, 12-15 xii 1948, 1 ♂, 2 ♀, Choelle Choel 21-24 Nov. 1948, 1 ♂, 1 ♀, Hayward & Willink, sent by Col. F. C. Fraser, coll. Univ. Tucumán. BRAZIL: São Paulo, 1 ii. 1935, leg. Wucherpfennig 1 ♀ coll. E. Schmidt, Rio Grande do Sul, ex coll. Staud., 1 ♂ coll. Geijskes. URUGUAY: Buschental, Dept. S. Jose, Feb. & Dec. 1935 H. Schneider 1 ♂, 1 ♀ coll. Cowley. Total 50 ♂, 44 ♀.

Distribution.—Pacific slope: Lima,⁴ Vicinity of Concepción, Peru, to Filuca Chile, 12°-41° S. Lat., 70°-75° W. Long. Atlantic slope: Humachuca, Argentina, and S. Paulo, Brazil, to Choelle Choel, Argentina, and Buschental, Uruguay, 23°-35° S. Lat., 46°-67° West Long. Both our own material (Filuca) and the records in the literature (Panguipulli)¹⁶ indicate *diffinis diffinis* as reaching farther south on the Pacific slope of the Andes than the Atlantic slope of the Andes (Villa Angostura), but farther east it reaches almost as far south (Choelle Choel) as on the Pacific Coast.

Altitudinal Range.—In Peru 3700-1700 m. (12139-5577 ft.), in Chile 1200 m. (3937 ft.) to sea level.

Seasonal Range.—The Peruvian specimens have been taken in the wetter months, March and April. Gazulla and Ruiz¹⁴ report *diffinis diffinis* as flying the entire year at Hacienda Mercedes, Chile. By far the greater number of our examples are from Chilean localities. The following quotations from climatological authors describe the precipitation conditions in that country. South of Caldera, Chile, "the rainfall increases rapidly . . . At Valparaiso we have left the arid tract and find 22 inches . . . Behind the coast range the aridity is at a maximum 84% falling in the four months May to August. This is one of the least cloudy and foggy parts of the west coast between the Equator and Cape Horn" (Kendrew, *Climates of the Continents*, 4th edition, 1953, 480-483). "The upper western slope of the Cordillera overlooking the longitudinal valley, has . . . considerable rainfall in summer . . . South of latitude 30° we are in an entirely different region; the land is no longer arid. At Santiago 1706 feet above the sea, the annual rainfall is 14 inches . . . snow is not unknown but is rare in the north" (p. 484); "beyond 40° S. we reach the zone of the westerlies and enter one of the rainiest regions on the earth" (Kendrew, p. 316, Oxford, Clarendon Press, second edition 1927). "North of the Equator and south of latitude 32° South, the western slopes of the Andes receive a heavier rainfall than the eastern slopes, while between the Equator and 32° S. the eastern slopes receive more than the western." (Brooks, C. E. P., *Climate*, New York, Scribners, no date but subsequent to 1928, p. 167). Of our Chilean specimens, both those taken at Santiago (518 m., 1700 ft.) and those taken along the coast at Taltal, Serena, Coquimbo, Concepcion, Angol and Filuca were captured in the drier

months, October to February. It appears, therefore, that the distribution of *diffinis diffinis* is not correlated with precipitation or with seasons; see Kendrew's maps, 2nd edition, pp. 310, 311, 4th edition, pp. 474-476.

♂. Face pale greenish blue, labrum approaching cadmium yellow in the apical half (Concepción, Peru), frons anteriorly immediately below the anterior transverse carina pale brown (Concepción, Peru) or black (Villa Alemana) or without these darker colors (Coquimbo), the grayish blue on the lateral upper surface continued (Coquimbo) or not continued (Concepción, Peru) downward on the sides of frons and of clypeus; fronto-clypeal suture with a brown line, pale (Talca) or darker at the sides (Concepción, Peru, Coquimbo), labium pale yellow basally, bluish distally, or pale pinkish throughout.

No pale antehumeral stripe or spot. Pale mesepimeral stripe narrowing upward, a little concave on its anterior margin in its upper half or in both upper and lower halves, pale metepimeral stripe of nearly uniform width, bent forward in its uppermost sixth; both epimeral stripes pale bluish, yellow at the lower end and below the metastigma, not margined with black. A Concepción, Peru male has the metasternum with a central round yellow spot bounded each side with brown. Legs dark indian red to black, tarsi black, first femora pale green inferiorly, second and third femora with two pale external lines.

Pale colors of the abdomen blue or pale brown. Segment 1 with more than the basal half brown, enclosing a small blue spot at extreme base, or all of the dorsum brown. Segment 2 with the dorsum brown almost to the dark brown or black transverse antemedian carina, followed on each side by a triangular blue spot (MD) bounded posteriorly by dark brown and confluent dorsally with its fellow of the opposite side. In individuals with well-preserved colors AD present on 2 or 3 to 7 or 8, MD triangular, on 2 or 3 to 8 or 9, PD on 2 to 7 or 10, largest on 7 or 8, separated from its fellow of the opposite side by a black, mid-dorsal, longitudinal line which is wider on 8 and 9, PMD on 3 or 4 to 7 or 8, AL on 1 or 2 to 8, confluent, or not confluent (Coquimbo), with AD on 2-6, ML on 2-7 or 8, largest on 6 and 7, PL on 1 or 2 to 8 or 10, confluent with PD on 2 or 3 to 8 or 9. Inflexed ventral part of terga of 3-8 pinkish or pale brown, darker brownish at hind end of each. Sterna of 3-8 and anterior half of sternum of 9 black, posterior half of sternum of 9 and all of sterna of 10 and 11 pale (blue in life?).

Vesicle of the penis shining black, hind margin apparently rectangularly pointed in the middle line, due to the manner of overlapping by the inflexed ventral parts of the terga. Genital lobe 1.4-1.8 mm. long at base, measured in prolongation of ventral margin of 2, distal end .9-1.23 mm. long, with 16-25 black spinules. Parameres of 9 dark colored, basal half pale.

Superior appendages longer than abdominal segments 9 + 10, in dorsal view the lateral margin gently convex throughout, the mesal margin slightly

bisinate, one concavity in the basal 2/5, the second in the distal 3/4, maximum width .78-.85 mm. at nearly one-half the appendage length, a superior longitudinal carina beginning before the mid-length of the appendage, nearer to the mesal than to the lateral margin, most strongly marked in the terminal .3 of the appendage length as described for the lateral edge view; in lateral edge view the lateral margin concave above throughout, lower margin convex throughout, a low, inferior, subbasal tubercle or tooth reaching to 1/4 to 1/6 of the appendage length, mesal margin convex below to a maximum depth of .5-.4 mm., the superior longitudinal carina in the terminal .3 of the appendage length having a maximum height of .38-.57 mm., the depth and the height both measured from the lateral margin; the longitudinal carina begins behind the point of maximum depth of the mesal margin; apex acute, forming an angle less than 90°.

Inferior appendage reaching to .53-.58 of the length of the superiors, in profile view concave superiorly, convex inferiorly throughout its length; in dorsal or ventral view its apex .14-.19 as wide as base, ending in two upturned denticles.

Wings colorless or faintly yellow in the first cubital cell of the hind wings or at the nodus of both front and hind; most of the venation in the anterior part of the wings pale brown, remainder black. Upper surface of stigma cologne earth (in some paler at the distal end) or brown ochre, under surface vandyke brown, pale brown, brown ochre or approaching cadmium yellow. Membranule of the hind wings brownish gray, basal half, or more or less than the basal third whitish.

♀. Differs from the male as follows: Face bluish, yellowish or brown, labrum approaching or not approaching cadmium yellow in the apical half, pale mesepimeral stripe almost straight, pale metepimeral stripe sinuous (Valparaiso ♀ which has a dark brown spot below the lower end of each pale epimeral stripe), both epimeral stripes pale yellow, metasternum pale brown, femora pale brown superiorly and with two pale superior stripes, abd. seg. 1 with a narrow, pale blue, mid-dorsal stripe on the anterior half and a transverse, dorsal blue stripe on more than the posterior half; AD not distinct on 2-10; MD large, confluent with each other and with ML on 2, small and triangular on 3-8; AL on 2 sending dorsad a stripe immediately in front of the black transverse antemedian carina, indistinct on 3, apparently present and confluent above with AD on 2-4 to 7-10; ML present and confluent with PL on 2, present on 3 to 8-10 and confluent in some with PL; PL on 2 and 3-6 or 3-10. Dorsum of 10 pale blue except for a transverse brown stripe occupying the anterior fifth. Inflexed ventral parts of terga of 3-9 pale (bluish or brown?), venters of 10 and 11 pale yellow. Appendages longer than 9 + 10, longer (São Paulo) or shorter (Penco, Choelle Choel) than 8 + 9, shorter than 8 + 9 + 10, lanceolate, maximum width .65-.90 mm. at .5-.6 of appendage length, mesal margin more convex than lateral margin and with longer hairs up to .5 mm. long, hairs of the lateral margin hardly more than spinules, less

than .08 mm. long. A slight yellowish tinge at the extreme base of wings, or the wings faintly yellow from base to stigma, from costa to R + M and Rs.

Dimensions.—Pacific slope: Abdomen (excl. apps.) ♂ 34.5-42 mm., ♀ 33-38, sup. apps. ♂ 4.44-4.74, ♀ 4.09-5.34, hind wing ♂ 30-35, ♀ 36-40, stigma, front wings, costal edge ♂ 2.55-2.79, ♀ 2.50-3.54, front wings, antenodals ♂ 10-13, ♀ 11-13, postnodals ♂ 7-10, ♀ 7-9, hind wings, antenodals ♂ 7-9, ♀ 8-10, postnodals ♂ 9-11, ♀ 9-11.

Atlantic slope: Abdomen (excl. apps.) ♂ 30.5-38 mm., ♀ 33.5-36.5, sup. apps. ♂ 4.58-5.00, ♀ 4.33-5.48, hind wing ♂ 35-37, ♀ 36.5-39, stigma, front wing, costal edge ♂ 2.70-3.36, ♀ 3.27-4.18, front wings, antenodals ♂ 12-15, ♀ 13-15, postnodals ♂ 7-9, ♀ 7-8, hind wings, antenodals ♂ 8-9, ♀ 8-10, postnodals ♂ 8-10, ♀ 8-9.

Ecology.—Porter and Edwards⁵ write of *diffinis*: Quilpué, this species is common, we have been able to observe it from Copiapo to Valparaiso in September. Joseph¹² gives the vernacular name of Matapiojos for the Odonata; in the ravines of Peñalolén, Ramon and Macul, near Santiago, at 1500 m. he has seen *Phenes raptor* capture other Odonata and his plate I is a reproduction of a photograph of *Ph. raptor* with an *Aeschna diffinis* recently caught; in a clearing in the woods of the agricultural building, numerous matapiojos of smaller species fly—*Aeschna diffinis*, *Erythrodiplax connata*, *Gomphomacromia paradoxa*—persecuting small insects in the rays of the sun which filter through the foliage; when *Phenes raptor* arrives the smaller species withdraw as if terrified or seek refuge in the branches. Father Pirion¹³ says *diffinis* is certainly one of the most common that exist in Chile; its geographic area extends from Peru and Bolivia to Tierra del Fuego. At Marga-Marga it is the most common of the 23 species which exist in the valley, it flies over estuaries, borders of ponds and dams; I have seen it very abundant in the high hills of the valley, probably in search of food; it flies in mist and prolongs its flight until sunset; as to its flight period, I have observed it eleven months of the year in the provinces of Aconcagua and Santiago; at San Cristobal hill I have taken it on sunny days in June; on August 14 I collected specimens in the ravine of Peñalolén; in September it is relatively abundant at Los Perales de Marga-Marga; it would not be rare for it to fly all the year perhaps because it has more resistance than the other species to the winter's cold and also perhaps because it finds throughout the year its preferred food, Diptera, Neuroptera and Ephemera; it meta-

morphoses on the branches of bushes which border water and these may be covered with thousands of larval exuviae; it is persecuted and devoured by swallows and toritos; its capture presents difficulties because its shy and rapid flight enables it to escape the net of the collector. Writing of the insects of Hacienda Las Mercedes, Chile, Gazulla and Ruiz ¹⁴ say of *diffinis*: very common, we believe that it flies during the entire year for we have observed an example whenever the sun shines. The remarks of these Chilean naturalists are here translated from the Spanish originals.

Discussion.—Rambur's description ¹ calls for "Thorax testacé, avec deux bandes jaunes très-obliques . . . marqué avant la première, d'un petit point de la même couleur." I understand this petit point to be the homologue of the antehumeral stripe of other species. Ris's ⁸ figure of the thorax shows a short pale antehumeral stripe, although in his text he says "Die meisten gut erhaltenen Exemplare von Mendoça zeigen ein kleines grünliches Komma als Schulterzeichnung; am keinem der chilenischen Exemplare ist ein solches zu sehen" (pp. 526-7). The "kleines grünliches Komma" of his figure 7a is surely the homologue of the stripe in his figures 4b, thorax of *haarupi*, which he calls Antehumeral (p. 523), and 5a, thorax of *confusa*, so that there can be no doubt that his "Schulterzeichnung" of *diffinis* is a lapsus styli, although in 1904 ⁷ he used "Schulterlinie" for the antehumeral stripe of *confusa*, *bonariensis* and *diffinis* (p. 24). An antehumeral point or stripe is lacking in all of the Chilean material before me and in the Concepción, Peru, male and the São Paulo, Brazil, female; the females from Montevideo possess it.

The figures in Blanchard's atlas ² are not very exact; that of *Aeschna diffinis* does not show the proximal side of the discoidal triangles as distinguished from other submedian cross-veins; it shows Rs forking proximal to the level of the stigma on all four wings, with mostly two rows of cells in the fork, 2-4 rows between that fork and Rspl, not the same in all four wings, and three vertical rows of cells in the anal loop of the hind wings, which does not agree with our material of *diffinis*. Blanchard's figure does not show the markings of the thorax which he describes; on the other hand it does show the single undivided cell at the proximal side of the triangles, the absence of supratrangular cross-veins and two rows of cells between Cu1 and

Cu2 of the hind wings in the proximal half only of that area, all of which agree with our present material.

M. René Martin wrote to me from Villa Alemana, Chile, on 26 March, 1922 (translated): I have a male of *Aeschna* which I believe to be a hybrid of *diffinis* and of *confusa*; it has the head of *confusa*, two wide yellow bands on the thorax, the reticulation of *confusa*, the first two segments of the abdomen of the same, the membranule entirely brown, the remainder is identical with *diffinis*.

Ae. (N.) *diffinis absoluta* Tables 2, 4, 5, 8, 11, 13, 17; Pl. XIV; Map 6. 1952. *Aeshna* (*Neureclipta*) *diffinis absoluta* Calvert, Ent. News 62: 258.¹

Material studied.—PERU: vicinity of Concepción, Andes, Felix Woytkowski, April 7-8, 1935, holotype ♂ and allotype ♀, paratypes 2 ♂, 3 ♀, April 26-27, 1935, paratypes 4 ♂, 1 ♀, April 25-29, 1935, 3400 m. a[bove] s[ea] level, paratypes 2 ♂, 3 ♀, all teneral, UM; Vilcanota, ex coll. Staud[inger], 1 ♀ "confusa Ramb. det Schmidt," coll. Geijskes; Cotahuasi, 9000 ft., Oct., 1911, Yale Peruv. Exp. 1 ♀, USNM. Total 9 ♂, 10 ♀.

Distribution.—12°-15° South Latitude, 70°-75° West Longitude. This area lies within the central zoogeographical province of Eigenmann and Allen, based on the distribution of the freshwater fishes.*

Altitudinal Range.—2700-3400 m. (9000-11,155 ft.). These altitudes fall within the region Quechua of Pulgar Vidal† and the Pajonales or Sierra division of Chavez Chaparro;‡ the latter author places them in the interandine subdivision of low ravines (quebradas bajas, p. 242).

Seasonal Range.—Our material has been taken in the months of April and October; in the highlands of Peru April is near the end of the rainy season, October near its beginning.§

♂. Frons above and face pale cadmium yellow, labium pale clay yellow; an isolated subquadrangular purple brown spot, laterad of the pale yellow stripe which borders the stem of the black T-spot of the frons, reaches laterad

* Fishes of Western South America, University of Kentucky, Lexington, Ky., pp. 40-41, 1942.

† Bol. Mus. Hist. Nat. "Javier Prado", Lima, 5 (2): 150, 1941.

‡ Rev. Univ. Cuzco 39 (99): 242-243, 1950.

§ Reed, W. W., The Climates of the World, in Climate and Man, Yearbook of Agriculture 1941, U. S. Dept. of Agric., p. 675.

to beyond the level of the end of the top of the T; a pale brown or black line on the fronto-clypeal suture.

Pterothorax a rather pale greenish brown, a pale bluish antehumeral stripe occupying a little less than the lower half of the mesepisternum, .74-1.23 mm. long, .25-.33 mm. wide, diverging downward (forward) from its fellow of the opposite side; pale yellow mesepimeral stripe .41-.82 mm. wide at mid-height, nearly straight; a pale yellow metepimeral stripe likewise reaching to the upper margin of its sclerite, .50-.65 mm. wide at mid-height, almost straight, continued on to the sides of abdominal segments 1 and 2; the pale brown markings on 3-10, AD, MD and PD, taken collectively exceed in area the black which bounds them on 3-7, but AD rapidly decreases on 7 and 8 and to zero on 9 and 10.

Appendages very similar to those of *diffinis diffinis*, wherefore the reference of *absoluta* to the same species; apex of the inferior .16-.25 as wide as its base in dorsal or ventral view.

Pterostigma pale brown ochre to pale vandyke brown above, in some paler at distal end, below gamboge. Membranule brown, basal 4th to 5th white.

♀. Differs from the ♂ in having the face a little darker and in the genitalia which are as described under the subgenus.

Dimensions.—Abdomen (excl. apps.) ♂ 34-36, ♀ 32.5-36, sup. apps. ♂ 4.17-4.75, ♀ 3.84-4.50, hind wing ♂ 34-36, ♀ 35-37, stigma, front wing, costal edge ♂ 2.37-3.45, ♀ 2.80-3.27 mm. Front wings, antenodals ♂ 13-14, ♀ 12-14, postnodals ♂ 7-9, ♀ 6-9, hind wings antenodals ♂ 7-9, ♀ 8-10, postnodals ♂ 8-11, ♀ 9-11.

Ae. (N.) elsia

Tables 2, 4, 5, 8, 11, 13, 17; Pl. XVI; Map 6.

1952. *Aeshna* (*Neureclipta*) *elsia* Calvert, Ent. News 63: 260.*¹

1875. *Aeschna confusa* Hagen, Proc. Boston Soc. Nat. Hist. 18: 39 (in part, only the Curico, Chile, examples).²

Material studied.—PERU: vicinity of Pacasmayo, May 20, 1936, a mating pair, holotype ♂ and allotype ♀, 1 ♂ paratype, Felix Woytkowski, UM; Pachitea, Staudinger vd. No. 1773, 1 ♂ "*Aeshna diffinis* Ramb." det. Cowley, Lima, Dr. P. Martin 1 ♂ "*Aeshna diffinis* Ramb." det. Cowley, coll. Cowley; vicinity of Chosica, Dept. Lima, 990 m. a[bove] s[ea] level, March 1, 1936, 1 ♂; vicinity of Villa, Dept. Lima, 120 m. a. s. level, March 15, 1936, 6 ♂, 1 ♀; Repartición, Dept. Lima, 140 m. a. s. l. February 28 & 29, 1936, 2 ♂: Chosica, Villa and Repartición examples by Felix Woytkowski, UM. CHILE: Tacna, Staudinger vd., 2 ♂ "*Aeshna diffinis* Ramb." det. Cowley, coll. Cowley. Azapa, 1.III.48, H. N. 1 ♀ and Miñi-Miñi, 18.II.48, 2 ♀, one with label

* This description should be corrected as follows: For "Frons pale clay yellow (Smith's Glossary, pl. iv, 22)" read "Frons pale blue" and page 262, lines 5 and 6, for "lector, Mus. Zool. Univ. Mich. Miñi-Miñi, 18.ii.48, 2 ♀ and Azapa, 1.iii.48, 1 ♀, Chile, Cornell Univ. Coricó, Chile, May," read "lector, Mus. Zool. Univ. Mich. Chile, Miñi-Miñi, 18.ii.48, 2 ♀, and Azapa, 1.iii.48, 1 ♀, Cornell Univ., Curico, May."

"*Aeschna diffinis* Rbr. Det. by J. G. Needham," coll. Needham, Cornell Univ., Curico 2 ♂, 1 ♀ MCZ., Patagonia 1 ♂ AMNH.

Distribution.—7° 20'–35° South Latitude, 71°–79° 30' West Longitude, embracing the Northeastern, North Central, Central Western, South Central and Southwestern zoogeographical provinces of Eigenmann and Allen,* based on fresh-water fishes, in part.

Altitudinal Range.—Sea-level to 990 m. (3200 ft.) in Peru.

Seasonal Range.—February to May in Peru, February and March in Chile, rather dry months in both countries.

♂. Face pale blue, fronto-clypeal suture with a brown line, yellow stripe bordering the black stem of the T-spot not as wide as the stem in the posterior half, wider than the stem in the anterior half, the yellow stripe followed laterad by greenish blue which extends laterad on to the side of the frons beyond the level of the acute end of the top of the T. Anterior surface of frons pale brownish to black in its upper half, pale bluish in its lower half; fronto-clypeal suture with a brown line; clypeus (nagus + rhinarium) pale bluish; labrum pale bluish or near gamboge, labium pale bluish to pale clay yellow.

Pterothorax pale greenish brown or brown pink (Smith's Glossary), pale antehumeral stripe absent; mesepimeral stripe, in well-preserved individuals, bluish white, reaching upward to the upper margins of mesepimeron and metepisternum, .9–1.6 mm. wide at mid-height, ending below in a crescentic yellow spot, convexity ventrad; this yellow spot is all that is visible of the stripe in many specimens. Metepimeral stripe bluish white, reaching to the upper margin of its sclerite, 1.2–1.6 mm. wide at mid-height, lower end narrowing to .5 mm. and yellowish. Tibiae black above and below.

Abdominal segment 1 largely pale brown on the sides, roman sepia on the dorsum. 2 with anterior half of dorsum roman sepia, a narrow (ca. .16 mm.) pale blue, mid-dorsal, longitudinal stripe from the anterior margin to the uninterrupted black, transverse, antemedian carina, not confluent with any other blue marking (not confluent with the dorsal end of AL—Villa), posterior part of dorsum bright blue; brown on the ventral surface anterior to the auricles more extensive (Chosica) than as shown in our figures 213 (Pacasmayo) and 219 (Curico), plate XVI. Pale spots MD, PD, AL, ML and P1 on 3–8 bright blue, MD and AL absent from 8 or 9–10, MD on 8 not larger than on 5–7, PD separated by a mid-dorsal brown or black line on 3–7, widening on 8 and 9, PD present on 9 and 10, separated or confluent on 10, AL on 3 reaching to the transverse antemedian carina, ML confluent with PL on 3–7 and 9–10, PL confluent with PD on 9.

Anterior lamina with the central triangular area pale (fig. 219, plate XVI) (Villa, Chosica, Curico) or dark (Villa, Reparticion), width of black on its

* Fishes of Western South America, Univ. Kentucky, Lexington, Ky., 1942, pp. 40, 41.

lateral margins variable, spines reaching caudad to the level of the hind margins of the hamular processes or of the hind margins of the hamular folds, anterior end of the sheath of the penis varying in its degree of acuteness; genital lobe in ventral view with 5-15 spinules.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, in dorsal view the inner (mesal) margin unisinate, *i.e.*, sinuate in the proximal half only and less deeply so than in *diffinis diffinis*, a superior longitudinal carina nearer to the mesal than to the lateral margin; maximum width of each appendage .61-.69 mm. at .52-.7 of appendage length, apex more or less obliquely truncated from within caudad and laterad to form a more or less acute tip. In profile view the upper margin concave, the lower margin convex throughout the length of the appendage, the superior carina most prominent in the terminal sixth to fourth of the appendage, an inferior, subbasal, triangular tubercle at one-fourth the appendage length, its distal side much steeper than its proximal side, extreme tip slightly variable in that it is straight (República, Villa, Curico) or bent slightly down (Pacasmayo) or bent slightly up (Pacasmayo); in the Chosica male the extreme tip of the left appendage is straight, that of the right bent slightly down.

Inferior appendage one-half as long as the superiors, apex in dorsal or ventral view .20-.21 as wide as base, ending in two upturned denticles.

Wings faintly smoky (clear in the Pacasmayo paratype), hind wings faintly yellow in the most proximal cell of all the spaces from C to the middle of the two proximal cells of the anal triangle, venation pale brown in the anterior part of wings from base to nodus, remainder darker, stigma reddish brown to dark ochre, slightly paler at the distal end, paler below to pale clay yellow. Membranule grayish brown, the extreme base, along the anal vein for a width of about .09 mm., white.

♀. Differs from the ♂ as follows: Brown line on the fronto-clypeal suture very pale to absent, the Curico female has the pale metepimeral stripe very narrow, its maximum width (at its lower end) is barely .40 mm., its width decreases upward and the stripe ends at slightly more than half the length of the sclerite; a female from Miñi-Miñi and that from Azapa have a pair of black subcircular spots on the mostly dark brown dorsum of abd. seg. 1, one on each side of the mid-dorsal line; in the Curico female the narrow pale mid-dorsal stripe on segment 2 extends from the base to the level of two black transverse black marks that lie half-way between the transverse carina and the hind margin of the segment (cf. fig. 211, from Villa, pl. XVI); the transverse carina of 2 at the mid-dorsal line less concave anteriorly than in females of *diffinis diffinis* (fig. 160, pl. XII, fig. 170, pl. XIII). Pale spots MD on 7 larger than on preceding segments, half as long as the segment, on 8 much smaller and more widely (.57 mm.) separated, on 9 united each side with PD; the mid-dorsal black on 8 is as wide, or almost as wide, as the segment behind MD, but narrows toward the hind end of the segment, on 9 it is narrower and of subuniform width (ca. .8 mm.) for the entire length of the segment. Pale

spots PD on 2-4 to 7-9, increasing in length relative to the length of the segments from 3 to 9, confluent with PL on 3-9. AL on 3 or 4-8, reaching to the antemedian transverse carina, ML confluent with PL on 3-7 or 8. Segment 10 mostly pale (blue or yellow in life?), a mid-dorsal black line for the anterior 4/5 of its length (Azapa ♀), anterior fourth narrowly black (Curico ♀).

Ovipositor pale brown, blackish on ventral edge, visible for whole length of genital valves.

Anal appendages longer than abd. segs. 9 + 10, lanceolate, in dorsal view the lateral margin nearly straight, mesal margin convex, a low, longitudinal, superior carina, hairs on the mesal margin longer than those on the lateral margin but distinctly shorter than the width of the appendage, maximum width of each appendage .61-.65 mm., at .53-.59 of the appendage length, apex rounded. In profile view appendages almost straight, apex rounded. The allotype ♀ has the wings faintly smoky, chiefly between the nodus and stigma. Stigma pale greenish or pale ochreous below.

Dimensions.—Abdomen (excl. apps.) ♂ 37-40, ♀ 35-39; sup. apps. ♂ 4.42-4.82, ♀ 3.93-4.25, hind wing ♂ 35-40, ♀ 36.5-40, pterostigma, front wing costal edge ♂ 2.6-3.35, ♀ 2.95-3.52 mm. Front wings with 11-14 antenodals 7-9 postnodals, hind wings with 8-9 antenodals, 7-10 postnodals.

Ecology.—The following notes are on the envelopes of specimens collected by Mr. Felix Woytkowski: the mating pair, holotype and allotype, from Pacasmayo "were taken over a pond between sand dunes", Chosica ♂ "Flying high rapidly over an irrigation ditch in strong wind, half cloudy day. Unic specimen seen Taken flying." Repartición "Taken flying over reeds upon a nearly dry swamp. Saw but 4 specimens & pretty wary." Villa ♂ "Very abundant anywhere in Laguna Villa."

Ae. (N.) galapagoensis

Tables 2, 8, 11, 13, 17; Pl. XVII.

1901. *Aeschna galapagoensis* Currie, Proc. Washington Acad. Sci. 3: 382 figs. 29, 30 (apps. ♂).¹

1904. *Aeschna galapagoensis* Needham, Proc. U. S. Nat. Mus. 37 (1371): 695, pl. xl, fig. 3 (nymph).²

1908. *Aeschna galapagoensis* Martin, Colls. Zool. Selys-Longchamps Cat. Syst. Descr. fasc. XVIII: 50, fig. 47 (apps. ♂).³

1922. *Aeschna galapagoensis* Campos R., Rev. Col. Nac. Vicente Rocafuerte 1922 (8/9): 34.⁴

1952. *Neureclipta galapagoensis* Calvert, Ent. News. 63: 258.⁵

Material studied.—GALÁPAGOS ISLANDS: Chatham,¹⁻² May 26, 1899, type ♂ No. 5419, type ♀ same number, both with red paper type labels and also white paper labels "*Aeschna galapagoensis* Currie Type ♂, ♀" in Currie's handwriting, ♀ type original of all figures on our plate XVII; "Acc. 21, 699

U[nited] S[tates] F[ish] C[ommission]" printed on white paper labels 2 ♂ 2 ♀, P. P. C.'s numbers 171, 174, 172, 173 respectively, 171 original of all ♂ figures on our plate XVII, total 3 ♂, 3 ♀ in U.S.N.M.; the male type has the head reduced to a skeleton (in a small paper envelope), abd. segs. 1-6 and anterior half of 7 lost; the distal halves of the sup. apps. of ♂ 171 broken off after the drawings were made, left front wing of ♂ 174 beyond the arculus lost. Isla Chatham, from Prof. F. Campos R. 1 ♂ 1 ♀ coll. P.P.C. Albemarle Is., Tagus Cove, March 10, 1935, Crocker Exped. Acc. 33813 1 ♀ AMNH. Total 4 ♂, 5 ♀.

The official Ecuadorean names of Chatham and Albemarle Islands are respectively San Cristobal and Isabela.

Distribution.—Galapagos Islands as above.

Altitudinal Range.—No data exist on the labels of our material or in the literature.¹⁻⁵ Beebe says "The shores of the islands are low, while in the interior, craters may rise to an extreme height of 5,000 feet." *

Seasonal Range.—March and April as above. Brooks remarks "The Galapagos Islands, on the Equator, near the coast of Ecuador, have the remarkably low mean temperature of 72 degrees, due to the presence of cold upwelling water." † Hesse, Allee and Schmidt say of these islands, "two ocean currents flow past them, one from the coast of Peru and one from the Gulf of Panama, but they are in a region of relatively little wind." ‡ Beebe: "Very little rain falls near the sea, where the vegetation is semi-desert, chiefly cactus and thorn trees. The luxuriance increases in the uplands where the moisture becomes more general." *

A. Leo gives a description of Seymour Island, of the Galapagos group, from observations made by the U. S. Army Corps between August, 1942, and August, 1945. The extreme maximum temperature recorded was 90° F. [32.2° C.] in January and February, the extreme minimum 58° F. [14.4° C.] in October. He states that two distinct seasons are present on Seymour, the rainy from late January through

* Encyc. Brit. edition of 1953, p. 968, art. Galápagos Islands.

† Climate, New York, Charles Scribner's Sons, p. 133, no date but subsequent to 1928 (cf. p. 143).

‡ Ecological Animal Geography, New York, Wiley; London, Chapman & Hall, p. 88, 1937.

April, the dry for the remainder of the year. The total annual rainfall was 3.97 inches [100.8 mm] of which 1.39 inches fell in February. "Almost daily during the afternoon in the rainy season rain showers and at times thunderstorms" occurred. The highest monthly rainfall recorded was 2.31 inches [58.7 mm.] in March, 1944. Four botanical regions were recognized "above the strand vegetation which forms a narrow belt along the shores of the islands in certain places": 1. Dry, receiving less than 5 inches (127 mm.) of rainfall a year, "covers the major portion of all the islands . . . a dull grey, sparse and scrubby thorn forest of very scattered dwarf deciduous trees between which grow coarse grass, low thorny bushes and cactus which sometimes attain a height of 40 feet" [12 m.]. 2. Transition region "composed of a mixture of xerophytic plants from the dry zone and the more hardy of the mesophytic plants from the moist region". 3a. Moist region, "characterized by heavy forests composed of trees sometimes 2 feet [.61 m.] in diameter; undergrowth often dense and resembles that of the moist tropics, the rain forest type being closely approached in places". 3b. Moist region between 1000 and 3800 feet (305-914 m.) on the mountain slopes, flora more abundant, decidedly mesophytic. 4. Grassy region. "Above 1500 feet [457 m.] in certain places the forests give way to meadows of long perennial grasses and ferns; except on protected places trees are almost entirely lacking" (Bull. Amer. Meteor. Soc. 27 (5): 200-209, 1946). The present material of *Aeshna galapagoensis* was taken in the rainy season.

♂. Face pale blue, some brown on the frons anteriorly below the carina; fronto-clypeal suture with a brown line; the yellow stripe which borders the black stem of the T-spot each side wider anteriorly, the wider brownish or bluish area which follows it laterad not separated by yellow from the black stripe along the eye margin. Labrum with a median black stripe, labium obscure bluish. Occiput pale blue, hind margin straight, rear of eyes black.

No pale antehumeral stripes, no pale lateral thoracic stripes (unless there be an indication of a mesepimeral on the right side of the male from Prof. Campos R.)

Legs black, first femora pale bluish inferiorly.

A transverse blue stripe on abd. seg. 2 immediately in front of a black stripe on the transverse antemedian carina. The markings on the succeeding segments faded, but PD discernible on 3-10 and MD on 3, PD separated from its fellow of the opposite side by a mid-dorsal black line on 3-7, by a wider

black stripe on 8 and 9, 10 mostly blue except for the anterior dorsal two-fifths; inflexed ventral part of tergum of 2 blue, of 3-8 (or 9?) pale brown, sterna of 3-8 and of anterior half of 9 black, of posterior half of 9 and all of sterna of 10 and 11 pale brown. Spines of the anterior lamina reaching to the level of mid-length of the hamular fold.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, subparallel with each other, lateral margin slightly convex throughout, mesal margin concave in proximal 2/5, less so in distal half, distal 2/3 strongly ciliate, the hairs longer than the width of the appendage, maximum width of appendage .74 mm., at mid-length; apex obliquely truncated from within outward to form an acute tip. In profile view the inferior subbasal tooth less acute than in *elsia*.

Inferior appendage about half as long as the superiors, apex .25 as wide as base, transversely truncated, ending in two upturned denticles.

Wings faintly smoky, pale yellow in bases of subcostal and cubital spaces and in the two basal cells of the anal triangle, costa to beyond the nodus, antenodals, some proximal postnodals pale brown, remainder of venation blackish. Stigma above cologne earth or roman sepia, slightly paler at extreme distal end, below hardly paler. Membranule brown, narrowly whitish at extreme base.

♀. The female from Tagus Cove, Albemarle Is. has the thoracic and abdominal markings so faded that, even by the use of 95% alcohol, I am not sure of their extent; it agrees with the four figures (223, 225, 230, 231, pl. XVII) of the allotype ♀, except that the antemedian transverse carina on abd. seg. 2 is very slightly more convex anteriorly at .4 mm. each side from the mid-dorsal line than shown in fig. 223. Anal appendages broken when received. Maximum width of appendages of two other females .65-.74 mm., at mid-appendage length.

Dimensions.—Total length ♂ 55, ♀ 57 mm. Abdomen (excl. apps.) ♂ 40-41, ♀ 36-40, sup. apps. ♂ 4.83-4.91, ♀ 4.17, hind wing ♂ 37-40, ♀ 38-41, pterostigma, front wing, costal edge ♂ 3.03-3.52, ♀ 3.19-3.52 mm. Front wings with 13-17 antenodals, 8-11 postnodals, hind wings 8-11 antenodals, 9-13 postnodals.

Discussion.—The original description¹ of the female says "10 almost wholly pale" but the allotype and the female from Prof. Campos R. have a mid-dorsal longitudinal black stripe .3-.4 mm. wide but narrowing forward.

Ae. (N.) bonariensis

Tables 2, 8, 11, 13, 17; Pl. III; Map 6.

1842. *Aeschna bonariensis* Rambur, Ins. Nev.: 204.¹

1861. *Aeschna bonariensis* Hagen, Syn. Neur. N. Amer.: 314.²

1875. *Aeschna bonariensis* Hagen, Proc. Boston Soc. Nat. Hist. 18: 39.³

1884. *Aeschna bonariensis* Bolivar, Artrop. Viaje Paccif. Madrid: 5.⁴

1904. *Aeschna bonariensis* Ris, Magalh. Samm.: 24, 25, 29.⁵
 1908. *Aeschna bonariensis* Ris, Deutsch. Ent. Ztschr. 1908: 523, 525, 526 figs. 6a (head, thorax), 6b (apps. ♂).⁶
 1908, 1909. *Aeschna bonariensis* Martin, Colls. Zool. Selys-Longch. Cat. Syst. Descr. fasc. 18: 51, 53, 84, fig. 53 (apps. ♂), fasc. 20: 213.⁷
 1911. *Aeschna bonariensis* Navas, Rev. Mus. Paulista 8: 477.⁸
 1913. *Aeshna bonariensis* Cockerell, Proc. U. S. Nat. Mus. 45 (2000): 580.⁹
 1913. *Aeschna bonariensis* Ris, Mem. Soc. Ent. Belg. 22: 85.¹⁰
 1922. *Aeschna bonariensis* H. Campion, Ann. Mag. Nat. Hist. (9) 10: 293.¹¹
 1933. *Aeshna bonariensis* Navás, Rev. Acad. Cien. Madrid (2) XXIX 14: 54.¹²
 1952. *Neureclipta bonariensis* Calvert, Ent. News 63: 257, 260, 262.¹³
 1920. *Aeshna bonariensis* var. *lutea* Navás, Mem. Accad. Nuovi Lincei 5: 11.¹⁴
 1908. *Aeschna dichrostigma* (Selys) Martin, Colls. Zool. Selys-Longch. Cat. Syst. fasc. 18: 53 (= *bonariensis* Martin 1908 l. c.).¹⁵
 1911. *Aeschna litigatrix* Navás, Rev. Mus. Paulista 8: 476.¹⁶
 1911. *Neureclipta litigatrix* Navás, t. c.: 478.¹⁷

Material studied.—ARGENTINA: Termas de Reyes, Jujuy, 22.I.46, Willink Monros 1 ♂, Tucumán, I 2 ♂, 3 ♀, II 1 ♂, XI 1 ♀, XII 1 ♀, '46 & '47, Goldbach, Lo Sarmiento, Dep. Rio Chico, Tucumán, 3.I.48, A. Ares 1 ♀, coll. Mus. Zool. Univ. Tucumán; Goya 1 ♂, Cordova 1 ♂ MCZ.; Alto de Serra, Prov. San Juan, 11 Mar., 1920, J. C. Bradley 1 ♂ coll. Wllmsn. UM; Capilla del Monte, Cordoba, I.47, Goldbach 1 ♀, Ciervo Petiso (S. Fé), IX.45, Dr. Villard 1 ♀ Mus. Zool. Univ. Tucumán; San Cristobal, Prov. Santa Fé, 19 Feb., 1920, 1 pair, 2 ♂, 4 ♀, J. C. Bradley, coll. Wllmsn., UM; Tigre, Bs. Aires, Jan. 1936, K. J. Hayward, 1 ♀ coll. Cowley; Rio de la Plata 1 ♂ MCZ; Buenos Aires, capital, 15.XII.1946, 1 ♂ apps. lost, coll. Mus. Zool. Univ. Tucumán. Patagonia 1 ♂ AMNH. BRAZIL: Alta Parana, 23 Jan., 1920, 1 ♂ and Iguazu Falls, Jan. 21, 1920, 3 ♂, J. C. Bradley, coll. Wllmsn. UM.; Sta. Helena 2 ♀, apices of abds. in bad condition, MCZ; S. Paulo, Feb. 1937, F. Wucherpfennig 2 ♀ coll. Cowley; Santos, S. Paulo, 5.24.1919, Thomas Hallinan 1 ♂ AMNH; Jaragua do Sul. Sta. Catharina, Fritz Hoffmann, 2.III.29 1 ♀, 5.IV.29 1 ♂, 29.X.1928 1 ♀ coll. E. Schmidt; Nova Teutonia, Sta. Catharina 7 Feb., Plaumann 1 ♂ coll. P.P.C. PARAGUAY via Fritz Wagner 1927 1 ♂, 1 ♀ coll. E. Schmidt; Sapucay, 8.1.1903 (W. T. Foster) 1 ♀ ANSP. URUGUAY: Buschental, Dept. San José, Feb. 5 ♂, 4 ♀, and May, 1935, 1 ♂, Dec. 1934 2 ♀, Dec. 7, 1935, 1 ♂, 1 ♀, Dec. 10, 1935, 1 ♂; Montevideo 1 ♀ USNM. Total 29♂, 29♀.

Distribution.—Jujuy in Argentina and Santa Leopoldina² in Brazil to St. Mathias Bay² in Patagonia and Montevideo, Uruguay; 15°-41° South Latitude, 42°-69° West Longitude. For references to descriptions of eastern Brazil see anteà page 31 under *Ae. (H) confusa*.

Altitudinal Range.—From sea level on the Atlantic coast (Santos, Montevideo, Buenos Aires) to 3000 m. ? (9842 ft.) in the province of Jujuy, Argentina.

Seasonal Range.—In the lower lands of Argentina, Uruguay and Brazil from September to May, moister months, in higher part of Argentina November and December and perhaps earlier and later.

♂. Face pale brown to pale blue, clypeus paler or pale lilac; fronto-clypeal suture with or without a dark line, bordered below on clypeus by a narrow yellow stripe; lateral bluish spot on the upper surface of the frons reaching laterad to or beyond the level of the end of the top of the T-spot and continued, or not continued, down on the lateral surface of frons and clypeus and separated by yellow from the black stripe along the eye margin. Labrum tending to yellow or orange in the middle, labium bluish or pinkish. Occiput yellow, hind margin straight or slightly concave.

Epimeral pale stripes of thorax nearly straight, of subuniform width.

Legs roman sepia or vandyke brown, first and second tibiae a little paler superiorly, tarsi blackish.

Abdominal segment 1 dorsum brown, 2 with a brown stripe in front of and parallel to the black transverse, antemedian carinal stripe, to which it is united at its upper end (not shown in our figures 35 and 36, plate III); pale spots on 3-10 as follows: AD on 2-4 to 5-8, the triangular MD on 2 or 3 to 7-9; PD on 2 or 3 to 9 or 10, separated from its fellow of the opposite side by black which is wider on 8 and 9; AL on 1-4 to 8 also on 10; ML on 2 to 8-10, largest on 6 and 7; PL on 1 or 2-10, confluent with PD on 1-5 to 8-10, with ML on 1 and 2; PMD on 3-7.

Proximal tooth on right auricle rounded in the Santos ♂. Anterior lamina dark-colored, an oblique pale stripe each side anterior to the spines. Mesal anterior prolongation of the hamular process broadly and convexly rounded anteriorly, forming an angle of less than 90°, mesal margin straight and parallel with the corresponding margin of its fellow of the opposite side; posterior part narrowing caudad, its lateral margin nearly straight, its mesal margin somewhat convex, apex not narrowed (as in *confusa*) but rounded. Genital lobe at base 1.21 mm. long, measured along the ventral margin of abd. seg. 2, .98 mm. long at apex, with 8-22 denticles.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, in dorsal view parallel with each other, lateral margin convex throughout, mesal margin concave in the proximal half, less so in the distal half, apex obliquely truncated from within laterad and caudad, forming an angle slightly less than 90°, extreme tip almost in line with the lateral margin, a superior, longitudinal, submedian carina subparallel to the mesal margin. In profile view the upper edge shallowly concave for entire length, the superior carina arched in the terminal fourth, mesal margin slightly convex to a maximum depth (see pages 17 and 18 anteà) of .08 mm., apex acute, an inferior subbasal tooth at 1/6 of appendage length (the caudal end of an inferior longitudinal carina).

Inferior appendage .42-.46 as long as the superiors, triangular in dorsal or ventral view, apex .21-.23 as wide as base, ending in two upturned denticles; in profile view the superior margin concave, inferior margin convex for entire length.

Wings uncolored, costa and veins Sc, R-M and M2 to beyond stigma and antenodals pale brown, remainder of venation dark. Stigma reddish brown, gamboge or pale cadmium yellow above, below gamboge. Membranule blackish brown, only the extreme base whitish in Atlantic examples, somewhat less than the basal half white (Termas de Reyes).

♀. differs from the ♂ as follows: Face pale brown, no dark line on the fronto-clypeal suture, yellow stripe on each side of the black stem of the T-spot of frons of subuniform width or narrower anteriorly, yellow but not orange on the middle of the labrum, antehumeral stripe pale green, .82 mm. long, first tibiae (not the second or the third) paler superiorly; area on abd. seg. 2 behind the antemedian transverse carina brown to the hind end of the segment; abdomen generally pale brown, pale spots AD-PL not distinct, faded?, carinae black; ventral inflexed terga of 3-9 yellow, venter of 10 yellow or pale blue; stigma approaching pale cadmium yellow, paler or not paler distally; membranule with only the extreme base narrowly white; ovipositor burnt sienna or yellow, tips black, reaching to the level of the hind end of the tergum of 9, genital valves likewise, their palps black, .57-.65 mm. long, pale at base; lateral genital plates yellow, reaching to, or almost to, one-half the tergum of 9; distal margins of basal genital plates slightly convex or straight in the same transverse line; ventral surface of segment 10 with 43-80 black spinules which are not distinctly grouped into paired areas; anal appendages as long as, or longer than, segments 9 + 10, longer than 8 + 9, in dorsal or ventral view with the lateral margin almost straight in at least the proximal 4/5, mesal margin convex throughout, a submedian longitudinal carina for almost entire length, apex acute, submucronate.

Dimensions.—Total length ♂ 53, ♀ 58 mm. Abdomen (excl. apps.) ♂ 34-39, ♀ 36-40, sup. apps. ♂ 4.50-5.07, ♀ 4.91-5.56, hind wing ♂ 34-36, ♀ 36-39, stigma, front wing, costal edge ♂ 2.62-3.11, ♀ 3.11-3.84 mm. Front wings with 12-15 antenodals, 7-9 postnodals, hind wings with 7-10 antenodals, 7-11 postnodals.

Ecology.—The pin-label of the Santos male reads: "Coffee groves in lowlands near city." Ris's observation,⁵ page 29, of *bonariensis* in association with *Ae. confusa*, in many hundreds, almost out of sight of land off La Plata, has been mentioned under that species, antea page 33.

Discussion.—I am not sure whether Bolivar's⁴ description of *bonariensis* applies to this species or to *diffinis*; his material came from Sur de Chile by Thamm. Of Thamm Horn u. Kahle say * "Thamm,

* Ueber entomologische Sammlungen, Ent. Beihefte aus Berlin-Dahlem, Bd. 2-4, p. 276, 1935-1937.

Franz Ausbeuten (spec. Coleopt. u. Lepidopt.) aus Peru u. Chile (ca. 1870/73) ex parte direkt, ex parte via Staudinger & Banghaas (Dresden-Blasewitz) vereinzelt." M. René Martin wrote me from Villa Alemana, Chile, of *bonariensis*: "J'ai pris 1 ♂ qui est certainement cette espece qui n'était pas indiqué du Chili" (17 avril, 1921). "L'an dernier j'avais pris plusieurs *Aeschna confusa* et 1 ♀ *Aeschna bonariensis*. Je ne l'ai pas encore revue en 1922, mais les Religieux ont pris 2 ou 3 ♀" (9 mars, 1922).

I have not been able to convince myself that the differences given by Navas¹⁵ are sufficient to distinguish specifically his *litigatrix* from *bonariensis*.

Genus CORYPHAESCHNA

1903. *Coryphaeschna* E. B. Williamson, Ent. News 14: 2 (generotype *ingens* Ramb).¹
 1918. *Coryphaeschna* Ris, Archiv. Naturgesch. 82 (A9): 169.²
 1929. *Coryphaeschna* Needham & Heywood, Hdbook. Dragfls. N. Amer. 131.³
 1930. *Coryphaeschna* Byers, Univ. Florida Publ. Biol. Sci. 1 (1): 69.⁴
 1932. *Coryphaeschna* Klots, Sci. Surv. Porto Rico & Virgin Is. New York Acad. Sci. 14 (1): 14, 19.⁵
 1943. *Coryphaeschna* Geijskes, Ent. News 54 (3): 61.⁶
 1944. *Coryphaeschna* Wright & Petersen, Ohio Jl. Sci. 44 (4): 154, 164, pl. 30 (nymph).⁷

Generic diagnosis.—Subnodal sector (Rs) forking under the stigma or at the level of its proximal end, with two rows of cells between the fork at the level of the distal end of the stigma; proximal side of the discoidal triangle of hind wings usually, but not always, less than one half as long as the hind (posterior) side; no ventral tubercle on abdominal segment 1, the sternum flat, spinulose, especially medio-posteriorly; males with each of the two ventral posterior angles of the tergum of 1 not produced into a mesad-projecting tooth, no dorsal tooth or strong carina on abd. seg. 10 (except in *secreta*), hind wing with the anal triangle 2-celled; females with the ventral surface of abd. seg. 10 produced ventrad and armed with 40-110 spinules up to .2 mm. long.

A key to the species of *Coryphaeschna* is given antea, page 15.

Coryphaeschna luteipennis Tables 2, 4, 5, 8, 11, 13, 18; Pl. VI, fig. 72, Pl. XXIV, figs. 311-322; Map 7.

1839. *Aeschna luteipennis* Burmeister, Hdbuch, Ent. 837.¹
 1861. *Aeschna luteipennis* Hagen, Syn. Neur. N. Amer. 314.²
 1875. *Aeschna luteipennis* Hagen, Proc. Boston Soc. Nat. Hist. 18: 39.³

1895. *Aeschna luteipennis* Calvert, Proc. Calif. Acad. Sci. (2) 4: 467, 502, 503, pl. XV, figs. 27, 28 (apps. ♂).⁴
 1898. *Aeschna luteipennis* Calvert, Trans. Amer. Ent. Soc. 25: 53 (Burmeister's types).⁵
 1905, 1907. *Aeshna luteipennis* Calvert, Biol. Centr.-Amer. Neur. 181, 186, 400.⁶
 1908. *Aeschna luteipennis* Martin, Colls. Zool. Selys-Longch. fasc. 18: 73, fig. 72 (apps. ♂).⁷
 1918. *Aeschna luteipennis* Ris, Archiv Naturgesch. 82 (A9): 170.⁸
 1866. *Aeschna excisa* Brauer, Voyage Novara Neur. 69, tab. I, fig. 19 (apps. ♂).⁹
 1867. *Aeschna excisa* Hagen, Verhdl. zool.-bot. Ges. Wien 17: 50.¹⁰
 1911. *Remartinia barbiellina* Navas, Rev. Mus. Paulista 8: 480, fig. 3 (apps. ♂).¹¹

In 1941, I proposed the recognition of three subspecies of *luteipennis* as follows:

Males with the inferior apical angle of the superior appendages rounded off, apical margin more convex, distance from the distal angle *o* of their internal emargination to the apex less, females with the pair of transversely elongated swellings near the anterior end of sternum of abdominal segment 2 almost continuous across the median line *luteipennis luteipennis*

Males with the inferior apical angle of the superior appendages distinctly angular, apical margin straight or concave, distance from the distal angle *o* of their internal emargination to the apex greater, females with each of the pair of transversely elongated swellings near the anterior end of sternum of abd. seg. 2 terminated usually by a slight elevation widened toward and meeting, or almost meeting, its fellow of the opposite side

luteipennis florida

Males with the inferior apical angle of the superior appendages distinctly angular, apical margin straight or slightly concave, distance from the distal angle *o* of their internal emargination to the apex greatest, female unknown

luteipennis peninsularis

These differences are illustrated by the accompanying text-figures 1-11, reproduced from the paper of 1941.

Coryphaeschna luteipennis luteipennis

Map 7.

1941. *Aeshna* (*Coryphaeschna*) *luteipennis luteipennis* Calvert, Annals Ent. Soc. Amer. 34: 392.¹²

The preceding references,¹⁻¹² 1839-1918, belong here also, at least in part.

1934. *Aeshna luteipennis* Calvert, Proc. Amer. Phil. Soc. 73 (1): 45 (larvae).¹³

1935. *Coryphaeschna luteipennis* Navas, Bol. Soc. Ent. Espana 17 (1-3): 33.¹⁴
1948. *Aeshna* (*Coryphaeschna*) near *luteipennis*? Calvert, Bol. Mus. Nac. Rio Jan. Zool. 87: 12, figs. 1-3 (larvae).¹⁵
1953. *Coryphaeschna luteipennis luteipennis* Racenis, Anales Univ. Centr. Venez. 35: 38.¹⁶

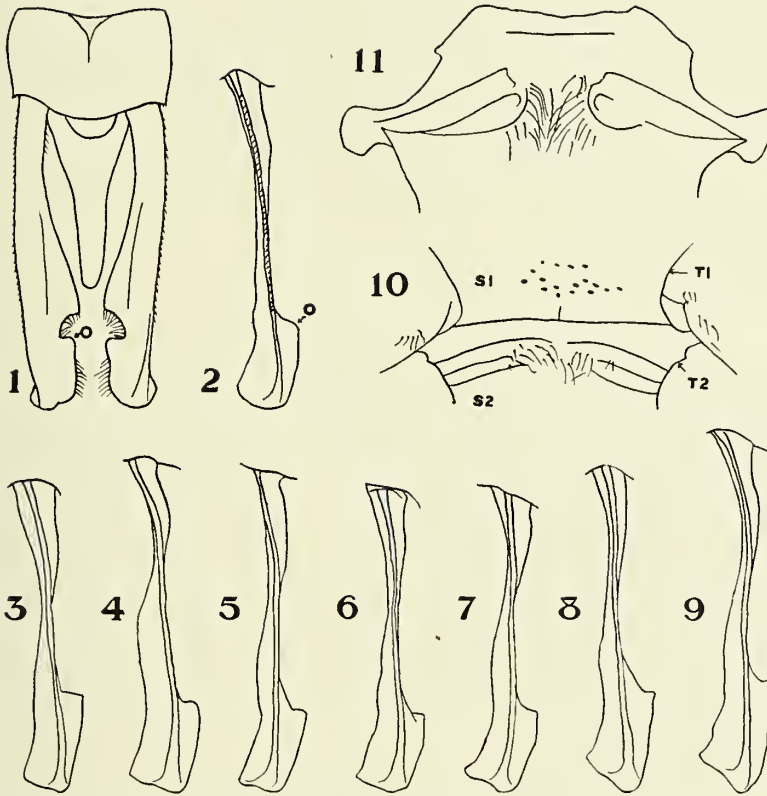
Material studied.—BRAZIL: Canta Gallo, Dr. Teuscher, Thayer Expedit. 1 ♂ MCZ.; São Paulo, Aug. 5, 1900. A. Hempel 1 ♀ ANSP. and 3 ♂, 1 ♀ coll. Cowley (1 ♂ and the ♀ March 1937 F. Wucherpfenning); Santos V.20. 1919 1 ♂ AMNH; Lago Vermelha, Lagoa Santa, M[inas] G[eraes], Machado, 21.4.49 1 ♂ No. 12,352 ex coll. N. Dias dos Santos; Nova Teutonia, Santa Catharina, 13 Mar. 1936, F. Plaumann 1 ♂ coll. P. P. C. Total 7 ♂, 2 ♀.

Distribution.—COLOMBIA: Río Aguacatal and San Antonio,⁸ Villavicencio;¹⁴ VENEZUELA: Zulia in Perija;¹⁶ BRAZIL: States of Minas Geraes to Rio Grande do Sul;⁸ 8° 30' North Latitude to 30° South Latitude, 40°-73° West Longitude. It is to be expected that this subspecies will be found between the Colombian and the Brazilian localities cited. P. H. Allen (Geogr. Review 37 (4): 567-582, 1947) and M. Bates (op. cit. 38 (4): 555-574, 1948) give descriptions of southeastern Colombia where these localities for *l. luteipennis* are and which are in the subtropical zone of Chapman 1917 and of de Schauensee 1948, based on the distribution of birds.

Altitudinal Range.—2000 m. (6562 ft.) at Río Aguacatal,⁸ Colombia, to sea-level at Santos.

Seasonal Range.—At San Antonio in Colombia September,⁸ in the Brazilian States March to May, also August, December and January.⁸ Kendrew (1953 *) says for south and east Brazil, Uruguay and Paraguay "The dry season is May to September which is the rainy season on the coast, and the worst droughts are in the months August to November . . . at Ouro Preto (Minas Geraes, within the tropics) water occasionally freezes and sugarcane may suffer great damage." pages 504, 505. *Coryphaeschna luteipennis luteipennis* flies in both dry and rainy seasons.

* The Climates of the Continents, Oxford, Clarendon Press, 4th edition, pp. 504, 505.



Figs. 1-3, 10. *Aeshna (Coryphaeschna) luteipennis luteipennis* Burmeister.

Figs. 4-7, 11. *Aeshna (Coryphaeschna) luteipennis florida* (Hagen).

Figs. 8-9. *Aeshna (Coryphaeschna) luteipennis peninsularis* Calvert.

1. Dorsal view of abdominal segment 10 and appendages, ♂, Canta Gallo, Brazil. 2-9. Left superior appendage, ♂, viewed laterally in such position that the widest part of the appendage shown in fig. 1 is in the same plane as the line of vision; *o* the distal angle of the excision in the inner (mesal) margin. In fig. 1 the lateral margin of each superior appendage is shown as bearing a row of short hairs; these hairs are shown on the corresponding margin in fig. 2, but are omitted from figs. 3-9.

2. Nova Teutonia, Santa Catharina, Brazil, March 13, 1936. 3. São Paulo, Brazil, March, 1937. 4. Volcan Chiriqui, Panama, Feb. 29, 1936. 5. Juan Viñas, Costa Rica, 3400 ft., June 23, 1909. 6. Cuernavaca, Morelos, Mexico, June. 7. Laguna Ochomogo, Costa Rica, 5000 ft., Sept. 29, 1909. 8. Mesa Verde, Baja California, Oct., 1893. 9. Los Parres, Baja California, Oct. 7, 1923.

10. Hind part of abdominal segment 1 and fore part of segment 2, ventral view, ♀, São Paulo, Brazil, March, 1937; S1 sternum of 1 bearing a median cluster of 17 fine denticles; S2 sternum of 2 with a transversely elongated swelling from side to side; T1, T2 lower (ventral) margins of terga of 1 and 2 which cover the lateral parts of their respective sterna.

11. Fore part of sternum of abdominal segment 2, ventral view, ♀, showing the pair of smooth areas, Las Concavas, Costa Rica, Oct. 12, 1914. This sternum has been detached from the remainder of the abdomen and hence is not covered by any terga.

All the figures are the same scale, $\times 7$. Fig. 1 tracing from drawing by Miss Elsie Lincoln, the others by P. P. Calvert.

♂. Face pale blue or with the frons anteriorly pale green, a well-marked, transverse, almost semicircular sulcus on upper anterior surface of frons extending downward on each side but not reaching the pale brown fronto-clypeal suture, this sulcus partly brown or black, the carina bounding it superiorly partly brown or black. Frons superiorly greenish blue with a black T-spot whose dimensions are given in Table 2, the stem shorter than the antero-posterior length of the markedly triangular top of the T; the stem not bordered each side by yellow, its base confluent with a transverse black stripe in front of vertex and antennae. Labrum pale bluish, a black line on the clypeo-labral suture, distal margin reddish, especially in the middle. Labium pale blue, distal half reddish. Vertex black, anteriorly greenish blue or with two greenish blue spots. Occiput yellow, each lateral margin black, or black with a central yellow dot. Rear of eyes dark indian red (Smith's Glossary), yellow below the occiput, or with a yellow spot each side.

Pronotum black to very dark brown, its hind margin bilobed, narrowly edged with yellow and bearing a row of pale brown hairs up to 1.23 mm. long; anterior margin of median lobe narrowly yellow; propleura and prosternum pale clay yellow.

Pterothorax with many pale or dark hairs .74-1.41 mm. long; mesepisternum dark indian red, a green or greenish blue antehumeral stripe 1.48-1.8 mm. wide at mid-height, of subuniform width, curved slightly at its lower (anterior) end toward its fellow of the opposite side, wider than the dark indian red which separates it from the mid-dorsal carina or from the humeral suture. Mes- and met-epimera green or pale greenish blue (dimensions Table 4), most of the metepisternum, infraepisterna, infraepimera and metasternum dark indian red.

Legs blackish to dark brown, second and third trochanters and femora at base slightly reddish, first femora pale blue.

Abdomen constricted at segment 3, blackish, the following spots greenish, bluish or yellowish: a triangular MD on 2-6, PD on a hairy, transverse, tubercular elevation of 1, on 2-7 or -8 confluent with its fellow of the opposite side, AL on 2-5 or -6, much smaller on 4-6, ML on 1 and 2 and confluent with PL, a mid-dorsal line for almost the entire length of 1, 3-7 and posterior half of 8;

most of each side of dorsum of 10 pale (Nova Teutonia, S. Paulo) or black (Lagoa Santa). Sternum of 1 and ventral inflexed parts of terga of 3-9 reddish, sterna of 3-8 or -9 and of 10 black.

Auricles of 2 with 3, more often 4 acute denticles on the hind margin, the lateralmost smaller. A pair of dorsal pits on 9 a short distance behind the anterior margin, less marked on 10. A pair of polished triangular areas, pointed posteriorly, in the intersegmental membrane following 2-9, the supplementary oblique dorso-lateral carina described for *Aeshna* absent or very faint; a low mid-dorsal carina on the posterior 2/3 of 9 and of 10. Sternum of 11: the oblique longitudinal carina converging caudad with the paranal longitudinal carina described for *Aeshna*, does not bear a tubercle as in that genus.

Margins of genital fossa black or brown, but of the genital lobe black. Anterior lamina pale-colored, its caudal end concealed by the anterior part of the hamular processes, apex shallowly bifid?, spines well developed, reaching to the level of the hind end of the hamular processes. Hamular processes dark-colored, prolonged forward into a slender acute process close to its fellow of the opposite side. Hamular folds partly concealed by the hind end of the hamular processes. Posterior hamules pale-colored, distal margin with pale setae, hind end concealed under (ventral to) genital lobe. Anterior end of sheath of penis acute, lying in the middle lobe of the genital fossa, posterior end transversely rounded. Glans penis lying in the hind lobe of the genital fossa below the anterior part of the two genital lobes, black. Vesicle of the penis black, between the articulation of the second and third abd. segs., anterior end transverse, convex. Genital lobe in profile view: base 1.3-1.5 mm. long, measured along the ventral margin of abd. seg. 2, apex .7-.9 mm. long, rounded off at each end, hence difficult to decide how long it should be considered, with about 15 minute denticles.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, in dorsal view subparallel with each other, each widening to 2/3 length where its maximum width is 1.1-1.4 mm., lateral margin almost straight, slightly convex, mesal margin concave in proximal 2/3 and just beyond this point shows a subquadrangular excision of .4-.65 mm. length, beyond which mesal and lateral margins are subparallel to the rounded apex; a superior longitudinal carina for most of the appendage length, this carina most prominent in the terminal fourth of the appendage length; between the superior appendages at base a rounded, almost semicircular, polished tubercle, .5-.65 mm. long—the vestige of the dorsal caudal appendage of the larva. In profile view the upper margin (lateral margin of dorsal view), exclusive of the superior carina, slightly convex throughout, lower margin bi-concave, i.e., in the proximal .6 and in the following .27 of the appendage length.

Inferior appendage reaching to .54-.6 of the length of the superiors, in profile view upper margin concave, lower margin convex for the entire appendage length; in ventral view triangular, apex .1-.16 as wide as the base.

Wings uncolored or with many of the veins bordered with pale brown, thus giving the wing itself that color, venation brown. Stigma surmounting 2 + to 3 + cells, indian red or dragons blood above, somewhat paler or even pale brown ochre below. Membranule pale brown or cinereous.

♀. Differs from the male as follows: Face pale blue, pale green or pale brown (faded?); anterior sulcus of frons pale blue, pale green or pale brown, the carina above it very narrowly yellow, no brown line on the fronto-clypeal suture in the Oxapampa female; the black stem of the T-spot longer than, or subequal to the antero-posterior length of the less markedly triangular top of the T; labrum pale brown or reddish (faded?); vertex pale blue with the hind margin black in one São Paulo female; no yellow on the occiput in the Oxapampa female; rear of eyes black with a yellow spot each side; pterothorax somewhat pruinose below, greenish blue antehumeral stripe up to 2 mm. wide; reddish more extended on the legs; ML on 1-9 and confluent with PL except on 7 in one São Paulo female, the pale spots on this same female reddish; 10 black on dorsum; sterna of 1-10 reddish or blackish; dorsal pits absent from 9 and 10; three low longitudinal carinae on the dorsum of 10 in the posterior 2/3 of its length, the median one on the mid-dorsal line, the other two close to it, or this area finely strigulose. Genitalia black except for a small elongate spot at the base of each genital valve, the lateral genital plates and the articulation of the palps with the genital valves yellow; ovipositor and genital valves of subequal length, reaching beyond the level of the hind end of the tergum of 9; in the Oxapampa female the ovipositor dragons blood or burnt sienna; palps .65-.74 mm. long, bearing the usual pencil of pale hairs .37-.41 mm. long; lateral genital plates reaching to mid-length of the tergum of 9; basal genital plates triangular, reaching to .2-.4 of length of ovipositor; anal appendages .65 mm. long, from 1/2 as long as to subequal in length to 10, flattened dorso-ventrally, in dorsal view the sides parallel, apex rounded or moderately pointed at the lateral margin; wings uncolored except for yellow at base, more pronounced in the subcostal and submedian (cubital) spaces to one cell beyond the arculus, or slightly smoky beyond the stigma (Oxapampa); stigma cologne earth, roman sepia, brown ochre or pale cadmium yellow above, gamboge below, surmounting 2 + to 4 cells, membranule cinereous.

Dimensions.—Total length, ♂ 74, ♀ 77 mm. Abdomen (excl. apps.) ♂ 49-54, ♀ 57-60, sup. apps. ♂ 5.07-6.22, ♀ 1.06-1.55, hind wing ♂ 44-46.5, ♀ 47-49, pterostigma, front wing, costal edge ♂ 3.68-4.33, ♀ 3.80-4.17 mm. Front wings with 17-22 antenodals, 10-13 postnodals, hind wings with 11-15 antenodals, 11-16 postnodals.

Coryphaeschna luteipennis florida Tables 8, 11, 13, 18; Pl. XXIV, figs. 315, 317, 318, 321, 322; Map 7.

1861. *Aeschna florida* Hagen, Syn. Neur. N. Amer.: 125.¹

1875. *Aeschna florida* Hagen, Proc. Boston Soc. Nat. Hist. 18: 35.²

1908. *Aeschna luteipennis* var. *florida* Martin, Colls. Zool. Selys-Longch. fasc. 18: 74.³
1918. *Aeschna luteipennis* Ris, Archiv. Naturgesch. 82 A (9): 170.⁴ (The Mexican and Costa Rican examples only).
1941. *Aeschna* (*Coryphaeschna*) *luteipennis florida* Calvert, Ann. Ent. Soc. Amer. 34: 394, figs. 4-7, 11 (details ♂ ♀).⁵

Material studied.—MEXICO:¹ Las Adjuntas (Munic. Villa de Santiago), Nuevo Leon, June 22/38, Hoogstraal 1 ♂; Chapala, Jal., Aug. 30, 1906 P. P. Calvert, 4 ♂; Cuernavaca, Mor., June, O. W. Barrett 1 ♂, July 30, 1935, H. Radclyffe Roberts 1 ♂, ANSP. COSTA RICA: Peralta, 1055 ft. (322 m.), Aug. 9/09 1 ♀; Juan Vinas, laguna, 3300 ft., March 19/10 1 ♂, May 4/10 1 ♀ ovipositing, 3400 ft., June 23/09, Schaus & Barnes 1 ♂; Paraiso, 4380 ft., Oct. 11/09, 1 ♀ ovipositing; Las Concavas, Oct. 12, 1914, C. H. Lankester, 1 ♂, 1 ♀; Cartago, 4760 ft. (1450 m.), May 15 1 ♂, June 17 1 ♂, June 18 1 ♂, Aug. 28 (E. of Cartago) 1 ♂, Nov. 2 (W. of C.) 1 ♂; Laguna Ochomogo, 5000 ft. (1524 m.), Sept. 25 2 ♂; Alajuela, 3100 ft. (944 m.), Sept. 15 1 ♀.* When the year is not given 1909 is to be understood, the collector P. P. Calvert. PANAMA: Chiriqui, 4100 ft. (1250 m.), June 23/37, C. B. Worth 1 ♀ ANSP; El Volcan Chiriqui, 29.II.1936, W. J. Gertsch, 1 ♂ AMNH. Total 18 ♂, 6 ♀.

Distribution.—Nuevo Leon, Mexico to Chiriqui, Panama. 24°-8° North Latitude, 82°-103° West Longitude. Tamaulipas Biotic Province, Lower Austral Zone and Humid Upper Tropical Zone of Goldman 1951 † in Mexico; Tropic, Subtropic and Cordilleran Belts of Carriker 1910 ‡ in Costa Rica; Tropical Zone of Griscom 1935 § in Panama—all based on the distribution of birds; and the basal and montane regions of Pittier 1908 in Costa Rica based upon plants; his basal region extends from 1-1000 meters and has a mean temperature of 28°-21° C., his montane region 1000-2500 m., with a mean temperature of 21°-14° C.; Carriker's use of the terms zones, regions and belts is variable as may be seen by comparison of his pages quoted in our footnote; and in the transition belt between the Nearctic and the Neotropical Regions (Chapala section) as based on the distribution of freshwater fishes of de Buen 1946.¶

* On August 6, 1909, at the Museo Nacional, San Jose, Costa Rica, I saw a male of this subspecies labeled S. Jose (B[iolley]).

† Goldman, E. A., 1951, Smithson. Misc. Collec. 115: 309-444.

‡ Carriker, M. A., Jr., 1910, Ann. Carneg. Mus., Pittsb. VI: 322-323.

§ Griscom, L., 1935, Bull. Mus. Comp. Zool. 78(3): 272-289.

¶ de Buen, F., 1946, Revista Soc. Mex. Hist. Nat. 7(1-4): 87-138.

Altitudinal Range.—1344-5000 ft. (400-1524 m.) in Mexico, 1055-5000 ft. (322-1524 m.) in Costa Rica.

Seasonal Range.—In Mexico June to August 30, in Costa Rica March to November 5, in Panama February and June. On the Mexican plateau June to August fall within the wetter part of the year (Page 1930*). The Costa Rican dates likewise occur in a wet season which, except for Alajuela is not sharply distinguished from the dry.†

It is interesting to note that although *luteipennis luteipennis* has been found in Brazil down to sea-level (Santos, with a mean annual temperature of about 8° F.), *luteipennis florida* has been taken thus far only on the plateau in Mexico where the mean annual temperature is mostly between 20° and 15° C. (68°-59° F.) (Calvert 1908, ‡ Hernandez 1923 §); extremes are Lampazos 22.2° C. and Toluca 12.6° C. The Mexican plateau is considered by H. M. Smith 1939 ¶ to be nearctic, based on lizards; these plateau localities lie in the Chihuahua-Zacatecas biotic province of Goldman 1951.**

Some twenty-five papers at least, published between 1920 and 1955, deal with biotic provinces of Mexico, based on studies of mammals, birds, reptiles, amphibians, fishes, coleoptera, homoptera, arachnids and plants. Dice 1939 pages 121-122, points out the correspondence, or the lack of it, between the associations or biota of different authors. The adaptability of organisms to a set of environmental conditions, which enables the recognition of a biota or an association, is different for each taxonomic group; hence the impossibility of establishing a strict equality between the biota of mammals and of birds, for example. Compare Hovanitz, W., 1945, *Caldasia* 13: 301-306.

* U. S. Dept. Agric. Weather Bureau Monthly Weather Review Suppl. 33, p. 22.

† Bealer, L. W., Article Costa Rica, *Encyc. Brit. edit. of 1953*, p. 499.—Calvo, J. B., *The Republic of Costa Rica*, Chicago & New York, Rand McNally & Co., 1890, p. 49. Pittier, H. *Ensayo sobre las Plantas Usuales de Costa Rica*, Washington, McQueen Inc., 1908, p. 12.

‡ Biol. Centr.-Amer. Neur. Odon., pp. v-xi.

§ U. S. Dept. Agric. Weather Bureau Monthly Weather Review Suppl. 23, pp. 3-5, Table 2. (Including both the Tierra Fria and the Tierra Templada.)

¶ Field Mus. Chicago Publ. Zool. 445, pp. 14-19; An. Escuela Nacion. Cienc. Biol. (Mexico) 2 (1): 95-102, map, 1940.

** *Smithson. Misc. Colls.* 115 (4017).

♂. Differs from the male of *luteipennis luteipennis* as follows: Propleura in part pale blue, the blue or green antehumeral stripe, 1.8-2.13 mm. wide at midheight, AL on 2-9, ML on 1 to 3-9, most of each side of the dorsum of 10 reddish or black, left auricle of one Ochomogo male with five teeth; wings varying from entirely uncolored (Cartago) to a faint trace of yellow in the submedian (cubital) space (Chapala, Ochomogo), faintly smoky in the posterior half and beyond the stigma (Cuernavaca, Juan Viñas, west of Cartago).

♀. Differs from the female of *luteipennis luteipennis* as follows: Fronto-clypeal suture with a pale brown stripe or line (Juan Viñas, Alajuela, Chiriqui), anterior sulcus of the frons brown (Peralta, Alajuela), stem of the black T-spot of frons longer than the antero-posterior length of the top of the T (Peralta, Alajuela, Chiriqui), labrum pale green (Juan Viñas, Alajuela), mes- and met-epimera green (4 ♀♀), green antehumeral stripe 1.64-1.96 mm. wide at mid-height, pale abdominal spots mostly faded, reddish, mid-dorsal area of segment 10 strigulose, ovipositor pale-colored in at least one female from Peralta (fig. 321, plate XXIV), anal appendages shorter than, or subequal in length to 10, apex rounded; wings uncolored (Paraiso, Las Concavas); or faintly smoky, more so beyond the triangles and still more so beyond the stigma (Juan Viñas, Alajuela), or smoky throughout (Chiriqui); costal, median and cubital spaces pale yellow (Peralta, Alajuela).

Dimensions.—Total length ♂ 73, ♀ 82 mm. Mexican examples: all males, abdomen (excl. apps.) 53-57, sup. apps. 5.24-6.25, hind wing 45-49, stigma of front wing, costal edge 3.76-4.17 mm. Costa Rican examples: abdomen (excl. apps.) ♂ 55-57, ♀ 59-62.5, sup. apps. ♂ 5.32-5.73, ♀ 1.06-1.22, hind wing ♂ 47-49, ♀ 48-50, stigma of front wing, costal edge ♂ 3.60-4.34, ♀ 3.68-4.34 mm.

Ecology.—I made the following notes on this subspecies in Costa Rica. Between Paraiso and Laguna Ochomogo, a distance of 6.8 miles (12.6 km.) and an increase in altitude of 227 m. (745 ft.) from 1339 to 1566 m. (4392 to 5137 ft.) *florida* was often observed or captured at a swampy spot in a grassy lane south of Cartago and at pools near the railroad tracks from May 15, 1909, to April 20, 1910. At Juan Viñas it was chiefly seen at the "laguna",* altitude 1000 m. (3280 ft.), a level area, apparently the floor of an old crater, covered with shrubs and grass, traversed by three ditches and used in 1909-10 as a cattle pasture; *florida* was often met flying along these ditches in June, July and October, 1909, and March and May, 1910; a male and a female flew into a house and were taken on June 24; it also flew along the railroad tracks in a cut. Oviposition was observed on October 8

* We have given a description and a picture of the "laguna" in "A Year of Costa Rican Natural History," New York, Macmillan, 1917, pp. 168-179.

near Cartago, on October 11 and April 20 near Paraiso, on March 19 and May 4 at the laguna at Juan Viñas. The female of October 8 laid her eggs in the stem of a sedge,* her abdomen immersed; she descended as more and more eggs were inserted until she was in water up to her mesothorax and her hind pair of wings laid flat on the water's surface; there was no male near or seen; some eggs in the piece of stem secured hatched and the larvae are described in Part II of the present paper. The pool in which this sedge grew had completely dried up by April 20, 1910; it was not quite two miles east of Cartago, on the south side of the railroad and not far from the tracks, being apparently a grasslined pocket in red gravel. On this same April 20 an Aeshnine female, possibly this subspecies, was seen ovipositing at the "Limnanthemum" pool on the railroad west of Paraiso station, between 9:30 A. M. and 1:30 P. M.; the day was occasionally sunny but mostly cloudy; this female was not taken, hence the identification is not certain. The ovipositing female of October 11 near Paraiso, which was taken while so engaged, was not accompanied by a male but a male was seen there at other times. A female at the laguna at Juan Viñas on March 19, 1910, was seen ovipositing in a stem of *Eleocharis*, her abdomen partly submerged.

Coryphaeschna luteipennis peninsularis Tables 8, 11, 13, 18; Map 7.

1941. *Aeschna* (*Coryphaeschna*) *luteipennis peninsularis* Calvert, Ann. Ent. Soc. Amer. 34: 395, figs. 8, 9 (apps. ♂).¹

1895. *Aeschna luteipennis* Calvert, Proc. Calif. Acad. Sci. (2) 4: 503, pl. xv, figs. 27, 28 (apps. ♂).²

Material studied.—MEXICO, Baja California: Parres, October 7, 1923, J. H. Williamson, holotype ♂ ex coll. E. B. Williamson; Mesa Verde,² Oct. 1893, G. Eisen, paratype ♂, both in ANSP.

Distribution.—Baja California, Mexico.

Altitudinal Range.—In the belt of 500-1000 m. (1640-3280 ft.)

Seasonal Range.—At present known only in October.

♂. Differs from the male of *luteipennis luteipennis* as follows: Superior anterior carina of the frons yellow, the superior T-spot of the frons faintly

* A piece of the stem of this sedge was secured and shown to Señor Adam Tonduz of the Museo Nacional at San Jose; it lies before me and bears a label, on the printed form of the herbarium, "*Eleocharis geniculata* R. Br. Det: C. D. Clarke".

indicated in pale brown, vertex mostly pale blue, hind margin and a narrow mid-dorsal stripe black, pale blue antehumeral stripe 1.96 mm. wide at mid-height, PD on 2-9, AL on 2-8, much smaller on 4-8, ML on 2-4, pale mid-dorsal line on 3-10, auricles with 5 teeth each side maximum width of superior appendages 1.31 mm., the excision .5 mm. long, tubercle between the superior appendages .5 mm. long, inferior appendage reaching to .57 of length of the superiors, apex .17 as wide as base, wings uncolored, stigma surmounting 2-3 cells, membranule cinereous.

♀. Unknown.

Dimensions (male only).—Total length 79 mm., abdomen (excl. apps.) 56.-58.5 mm., sup. apps. 6.54, hind wing 45-47, stigma of front wing, costal edge 3.60-4.09 mm. Front wings with 19 antenodals, 11-12 postnodals, hind wings with 13-14 antenodals, 12-14 postnodals.

Living colors.—The colors given in ² are essentially those of life.

Discussion.—It would appear that *luteipennis*, including its three subspecies, is a rainy season species.

Coryphaeschna rufipennis Tables 2, 4, 5, 8, 12, 13, 18; Pl. XXXII, figs. 445-453; Map 7.

1941. *Aeshna rufipennis* Kennedy, Ann. Ent. Soc. Amer. 34: 397, figs. 10-14 (details ♂).¹

1944. *Aeshna rufipennis* Kennedy, op. cit. 37: 372, figs. 1-6 (details ♀).²

Material studied.—ECUADOR: Rio Pupuyacu (which I have not located), alt. 500, Nov. 16, 1934, no collector's name, 2 ♂ coll. Kennedy. PERU: Satipo, holotype ♂, Dec. 27 1 ♀, allotype May 23² coll. Kennedy (now UM), paratypes 3 ♂, Nov. 26, Dec. 12 & 15; May 24-June 20, 6 ♂, UM, ANSP, all in 1940, collected by Pedro Paprzycki. Total 12 ♂, 1 ♀.

Distribution.—Ecuador as above; in Peru known only from Satipo which is shown by the American Geographical Society's map of 1942 as at about 1000 m. (3280 ft.) altitude, in the province of Junín, on a tributary of the Rio Perené; it is in the Yunga Fluvial region of Pulgar Vidal (1941*), and in the Central Zoogeographical Province of Eigenmann and Allen (1942†) based on fresh-water fishes.

Altitudinal Range.—500-1000 m. (1640-3280 ft.) as above.

Seasonal Range in Peru.—May 23-June 20, Nov. 26-Dec. 27, all 1940. The nearest comparable meteorological stations to Satipo are Iquitos, far to the north (alt. 348 ft.) and La Merced, much nearer

* Bol. Mus. Nat. Hist. Javier Prado, Lima 5(2): 150-152.

† Fishes of Western South America, Univ. Kentucky, Lexington, Ky., pp. 40-41.

(2460 ft.).* They record rain throughout the year but May and June, November and December are not the rainiest months, although December at Iquitos is the second rainiest month. Satipo is in a very unstable earthquake area; it was reported as "virtually destroyed by earthquake and floods" in early November, 1947. The same tremors "hit and heavily damaged the towns of Huancayo, Tarma, Cerro de Pasco, Juaja, San Ramon and La Merced" (Philadelphia Inquirer Nov. 3, 1947).

♂. Face pale blue, a brown line on the fronto-clypeal suture; eyes olive green above, bluish green below, their line of contact 2.27 mm. long; anterior surface of frons with its transverse superior sulcus occupied by brown which is continuous with the black T-spot, top of the black T-spot on the upper surface of the frons produced more acutely at each end than shown in Kennedy's² fig. 2, stem of the T-spot at mid-length of the whole spot .5 mm. wide, its sides not parallel but diverging cephalad, anteclypeus (rhinarium) violaceous; free margin of labrum narrowly edged with brown, mandibles pale blue, narrowly edged with brown; labium pale blue, distal half of ligula, distal mesal angle and a smaller lateral spot on palps brown. Occiput entirely black (6 ♂♂), with a small yellow spot on both dorsal and hind surfaces (2 ♂♂). Rear of eyes (postgenae) black, a bluish spot opposite the situation of the hind margin of each eye.

Prothorax blackish, hind margin trilobed, pale blue, the median lobe wider than either lateral lobe.

Pterothorax moderately hairy, hairs pale; a dark brown, mid-dorsal, antealar stripe widening cephalad, the mid-dorsal carina narrowly green in its anterior (oblique) section. A bright green antehumeral stripe 1.8 mm. wide at mid-height, at which it is a little wider than the mid-dorsal brown and subequal in width to the humeral brown; it is a little wider at its upper (posterior) end than at its lower (anterior) end. The humeral brown extends only slightly posterior to the humeral suture, covers also the mesinfraepisternum (katapisternum) and runs mesad along both anterior and posterior borders of the mesepisternum to meet the mid-dorsal brown. Sides behind the humeral suture predominantly bright green, a brown stripe 1.3 mm. wide at mid-height on the second lateral (metapleural) suture, widening below to surround the metastigma and unite with brown covering the pectus and the latero-ventral carina. Antealar sinus of both front and hind wings bright green.

Legs blackish brown, first femora pale blue inferiorly, second and third femora reddish brown at the extreme base only (3 ♂♂), or in nearly the proximal half (5 ♂♂); tarsi black.

* Reed, W. W., 1928, Monthly Weather Review, Suppl. 31: 17, U. S. Dept. Agric., Washington.

Abdomen constricted at base of segment 3 as per Tables 4 and 5. Abdomen dark brown anteriorly to black posteriorly, with the following green markings, brighter on segments 1 and 2: a spot on the posterior transverse dorsal tubercle of 1 (tubercle and adjoining areas with many brown hairs); an anterior AD and a posterior mid-dorsal PD stripe on 2; most of the sides of 1 and 2, including the dorsal, but not the ventral, half of the auricle and the inflexed ventral part of the tergum of 2; a pair of mid-dorsal triangular spots MD on 3-6; a pair of smaller posterior dorsal spots PD on 3-7; a pair of antero-lateral spots AL on 3; margins of the gonapophyses (parameres) on 9.

Genitalia of 2: spines of the anterior lamina in ventral view straight and almost parallel, brown, ventral edge narrowly green; hamular processes and folds brown, of shapes shown by Kennedy¹ figs. 13 and 14; genital lobe with about eight denticles on its free margin which is dark brown.

Abdominal segment 10 in dorsal view with a mid-dorsal, longitudinal carina which at its anterior end divides to form a triangular area whose base is at the anterior margin of the segment; on each side of this triangle a transverse groove to the lateral margin of the segment; on each side of the mid-dorsal carina at the hind margin of the segment a slight subcircular shallow pit, whose diameter is about $1/7$ of the segment's length and whose bottom is not polished; anterior to this pit is a slightly larger circular pit whose bottom is polished. Between the bases of the superior appendages is a mid-dorsal polished tubercle, .57 mm. long, similar to that of *luteipennis*.

Superior appendages longer than abdominal segments 9 + 10, shorter than 8 + 9, about $3\frac{1}{2}$ times as long as 10, black. In dorsal view the lateral margin almost straight for $\frac{3}{4}$ length, thence convex to apex; mesal margin widening to $\frac{1}{2}$ length where it forms a truncated tooth followed by a deep subquadrangular excision, beyond which the margin is thickened in such a way as to form a hook directed a little mesad. In lateral view this hook is directed caudad and ventrad and the hind boundary of the deep excision marks the anterior end of a carina extending into the apical hook; the anterior part of this carina bears a tuft of brown hairs, present in *luteipennis* also.

Inferior appendage blackish, reaching to the level of $\frac{1}{2}$ length of the superiors, markedly concave dorsally in profile view, in ventral view triangular, tapering to the rather obtusely rounded apex.

Wings slightly fumose throughout, the base paler (7 ♂♂), or strongly brownish throughout, extreme at the extreme base (1 ♂); stigma surmounting 2 + to 3 cells, reddish brown; membranule cinereous.

♀. Described from the allotype, colors not well preserved. Differs from the male as follows: Face brown, some hint of olive in life, eyes brown (faded), their line of contact 2.21 mm.; sides of the stem of the black T-spot parallel in the posterior half where the stem is .5 mm. wide; that part of the top of the T which extends into the transverse superior sulcus of the anterior surface of the frons less visible; sides of frons, of clypeus (nasus), of mandibles and of labrum perhaps bluish in life, rhinarium pale bluish (?) in life,

free margin of labrum not darker, distal half of ligula reddish, occiput entirely black. Mid-dorsal thoracic carina has lost its green, if it had it in life, brown stripe on the second lateral suture perhaps a little wider, its anterior edge indistinct, second and third femora reddish at extreme base only. Abdominal colors much faded, apparently as in the male but with the following additional pale (green in life?) markings: AL on 3 longer, reaching to the antemedian transverse carina and there united with ML + PL; AL present on 4-7, not reaching to the antemedian transverse carina, very small on 5-7; PL present on 9, nearly one-half as long as the segment; a mid-dorsal longitudinal line on more or less of 3-7; on the posterior part of 4-7 is an elongate spot at a lower (more ventral) level than PL of 3 or of 9—does it represent PL?; inflexed ventral part of the terga of 2-8 and the posterior third of the sternum of 8 with some pale coloring. Anterior end of the sternum of 2 similar to that described for and figured for *luteipennis luteipennis* pages 145, 147. Dorsal surface of abdominal segment 10 with two paramedian longitudinal carinae, not entirely distinct from each other, laterad to each carina and just in front of the hind margin of the segment an oval polished depression about $\frac{1}{3}$ as long as the tergum; the triangular basal area of the male is represented, but smaller, the transverse groove to either side of the triangular area much less pronounced; sternum of 10 with numerous acute spinules of which the hindmost are the longest. Anal appendages straight, black, a little longer than the tergum of 10, apex obtusely rounded in ventral view. Wings fumose throughout, not distinctly yellowish at base, membranule pale dull brown.

Dimensions.—Total length 74 mm. Abdomen (excl. apps.) ♂ 47-53, ♀ 61, sup. apps. ♂ 5.9-6.05, ♀ 1.47, hind wing ♂ 43-46, ♀ 51, stigma front wing costal edge ♂ 3.27-3.60, ♀ 3.76 mm. Front wings with 19-22 antenodals, 11-14 postnodals, hind wings with 12-15 antenodals, 12-16 postnodals.

Coryphaeschna secreta Tables 2, 8, 12, 13, 18; Pl. XXXIV, figs. 463-466; Map 7.

1952. *Coryphaeschna secreta* Calvert, Ent. News 63: 262.¹

Material studied.—CUBA: S. Diego d. l. Banos, April 14.00, Palmer & Riley 1 ♂ USNM.

Distribution.—Known only from Cuba as above.

Altitudinal Range.—About 200 m. (656 ft.).

Seasonal Range.—April—end of a dry season (Reed 1941 p. 673*).

♂. Face, including lips, pale brown ochre (Smith's Glossary pl. iv, 36), only a faint brown indication of a T-spot on the dorsum of the frons, vertex pale vandyke brown.

* Yearbook of Agric. 1941, U. S. Dept. Agric., Washington, p. 673.

Pterothorax darker vandyke brown, antehumeral (mesepisternal) green bands 1.47 mm. wide at maximum (midheight), narrowing inferiorly; mesepimeral blue green band ca. 1.15 mm. wide at mid-height, 2.05 mm. at upper end; metepimeral blue green band with maximum width of ca. 1.64 mm.; antehumeral, mes- and metepimeral green bands all narrower than the intervening brown. Femora pale brown.

Abdomen a pale reddish brown (faded?), pale bluish or greenish spots as follows: triangular MD on 3-6, a pair of triangular PD on 3-6, a pale yellowish, vertical, linear AL on 4-6, others, if present, faded, no pale spots on 9 and 10. Transverse carina on 2 not interrupted in the middle although there is some roughness there as fine impressed lines converging anteriorly in two areas, one on each side of the mid-dorsal line.

Spines of the anterior lamina without a basal hair-bearing tubercle. No oval (or other) impression in front of the apex of the sternum of segment 3, 3-10 with a mid-dorsal longitudinal carina for entire length of each segment, that on 10 not elevated as in the subgenus *Aeshna* and other subgenera, and no tubercle on either side of the carina of 10.

Superior appendages in bad condition, the left 5.15 mm. long, the right broken off at .29 length, the left with a piece .57 mm. long broken out of the lateral margin just beyond half-length; left appendage with lateral margin slightly sinuate in the middle third of its length, inner (mesal) margin narrowed to .2 of appendage length, thence gradually widening to mid-length, thence narrowing to .83 length, whence the appendage is of nearly uniform width to the rounded apex; distal half of inner margin with hairs longer than appendage width, a distinct, inferior, subbasal tooth at .14 of appendage length. Superior appendages more deeply sinuate on the inner margin in the distal half than shown for *longfieldae* in dorsal view, in profile view the outer margin not sinuate. Inferior appendage broken off (at somewhat more than half-length?).

Wings hyaline with no tinge of color, no "schmutzig grau gegen die Spitze" as Hagen described for *januaria*; costa and most of other veins reddish brown (near dragons blood of Smith's Glossary); stigma surmounting 2 + to 3 cells, pale clay yellow; membranule pale gray; area on hind pair between Cu1 and Cu2 with one row of cells throughout—this character variable in *luteipennis* (see Table 18).

Dimensions.—Total length 74, abdomen (excl. apps.) 51, sup. apps. 5.15, hind wing 47, its width at nodus 13, stigma, costal edge, front wing 3.93 mm. Front wings with 19-21 antenodals, 12 postnodals, hind wings with 11-13 antenodals, 11-14 postnodals.

♀. Unknown.

Discussion.—By Martin's key to the species of *Aeschna* (Colls. Zool. Selys-Longchp. fasc. 18, pp. 79-80, 1908) this species runs to *januaria*.

Coryphaeschna ingens

Table 13; Pl. XIX; Map 7.

1842. *Aeschna ingens* Rambur, Ins. Nev. 192 ("Collection de M. Serville, sans indication de patrie").¹
1861. *Aeschna ingens* Hagen, Synop. Neur. N. Amer. 128.²
1875. *Aeschna ingens* Hagen, Proc. Boston Soc. Nat. Hist. 18: 36.³
1886. *Aeschna ingens* Gundlach, Neur. Cuba 239 ("vencindad de Cardenas").⁴
1903. *Coryphaeschna ingens* E. B. Williamson, Ent. News 14 (1): 8, pl. II, fig. 2 (venation ♂).⁵
1903. *Coryphaeschna ingens* Calvert, Ent. News 14 (1): 8.⁶
1903. *Aeschna ingens* Needham, Proc. U.S. Nat. Mus. 26, pl. xl, fig. 2 (venation ♂).⁷
1904. *Aeschna ingens* H. Butler, Trans. Amer. Ent. Soc. 30: 121, pl. vii, fig. 4a (labium).⁸
1906. *Coryphaeschna ingens* Brimley, Ent. News 17: 84 (N. Car.).⁹
1908. *Aeschna ingens* Martin, Colls. Zool. Selys-Longch. fasc. XVIII: 77, fig. 76 (apps. ♂).¹⁰
1909. *Aeshna ingens* Calvert, Ann. Carn. Mus. Pittsb. 6: 222 (Bahamas).¹¹
1913. *Coryphaeschna ingens* Cockerell, Proc. U. S. Nat. Mus. 45 (2000): 580 (venation).¹²
1919. *Coryphaeschna ingens* Kennedy, Ent. News 30 (4): 105, figs. 1-3 (naiad).¹³
1919. *Aeschna ingens* Calvert, Trans. Amer. Ent. Soc. 45: 358.¹⁴
1923. *Coryphaeschna ingens* Navas, Arxius Inst. Cien. Barcelona 7: 181 ("Gulfport, Florida, sept. de 1916, Reynolds").¹⁵
1924. *Coryphaeschna ingens* Navas, Revista R. Acad. Cien. Exact. Fis. Nat. Madrid 21: 324 (Santiago de las Vegas (Cuba, by F. Z. Cervera) 2 de Agosta de 1923").¹⁶
1925. *Coryphaeschna ingens* Brimley, Ent. News 36 (2): 85 (nymph).¹⁷
1929. *Coryphaeschna ingens* Needham & Heywood, Handbk. Drgfls. N. Amer. 23, 131.¹⁸
1930. *Coryphaeschna ingens* Byers, Univ. Fla. Publ. Biol. Sci. Ser. 1 (1): 12, 70, 253, 300, fig. 10 (nymph).¹⁹
1940. *Coryphaeschna ingens* Montgomery, Jl. Elisha Mitchell Sci. Soc. 56 (2): 290 (So. Car.).²⁰
1955. *Coryphaeschna ingens* Needham & Westfall, Manual Drgfls. N. Amer., Univ. Calif. Berkeley & Los Angeles p. 280.²¹
1863. *Aeschna Abboti* Hagen, Stett. Zeit. Ent. 34: 373, no. 55, 374.²²
1874. *Aeschna Abboti* Hagen, Proc. Boston Soc. Nat. Hist. 16: 350.²³

Material studied.—FLORIDA: within 3 miles of Gulf Hammock post office, March, 1929, 1 ♀ and Gunntown, April 1-8, 1923, 1 ♂, 2 ♀, both in Levy County, by Philip Laurent, Coronado, Volusia Co., 1915, Dr. D. M. Castle 1 ♂ 6 ♀ ANSP.; Gotha, Orange Co., April 24 1 ♂, 1 ♀, 6/15 1 ♂, 7/22 2 ♂,

no date 1 ♂, Johnson Island, Osceola Co., March 17 and 20 all 1897 by A(dolph) H(empel) 3 ♂ 1 ♀ ex coll. C. C. Adams; Lake Placid, Archbold Biol. Sta., 20 March, 1945, J. G. Needham 1 ♂; Lake Okeechobee, Heilprin Exped. ANSP 1886 1 ♂; Palmdale, DeSoto Co., April 5 1 ♂, 1 ♀ and Fort Myers, Lee Co., March 10 and 19 3 ♂, 1 ♀ by J. H. Williamson 1921; Miami, Dade Co., III.16 1915, Morgan Hebard 1 ♂; Royal Palm State Park, Feb. 28, 1927, Frank M. Jones 1 ♂, 1 ♀. CUBA: Soledad (Santa Clara Province), 30.iv. 1 ♀ apps. lost, coll. Needham; except the specimens in Prof. Needham's collection, and 1 ♂ from Fort Myers in Mr. Cowley's collection, the above material is in the collection of the ANSP. Total 18 ♂, 15 ♀.

Distribution.—Williamston,¹⁷ North Carolina, to Cuba.² Martin¹⁰ adds Chiriqui. Latitude 35° 50' to 8° North, Longitude 74° to 85° West.

Seasonal Range.—April 14 to August 20 in Florida²¹ February 12, "the wet season occurs in Florida from June to September or October."¹⁹

Altitudinal Range.—Sea-level to not more than 375 feet (114 m.). It lies in the humid division (Australriparian Fauna) of the Lower Austral part of the Austral Region and in the Tropical Region of Merriam et al. as shown by J. R. Carpenter, Ecological Glossary, Appendix VI, University of Oklahoma, Norman, 1938, and in Australriparian Faunal Division of the Lower Austral Life Zone and in the Tropical Life Zone of Muesebeck & Krombein, Syst. Zool. I (1): 25-26, 1952.

♂. As a number of fairly full descriptions of this species^{1 2 4-6 19} exist, the present account is limited to some features not, or but briefly, described in them. Pale green spots on abdominal segment 2: no AD or MD, but a green dorsal spot anterior to the submedian transverse carina united ventrally with AL; AL + ML + PL + PD confluent.

Auricles of 2 with four denticles on the hind margin, the lateralmost shortest. Spines of the anterior lamina pale brown, blackish at apex which reaches caudad not as far as the level of the apex of the hamular processes. Hamular processes brown, anterior part with mesal margin parallel with that of the fellow of the opposite side, its antero-mesal angle very acute. Hind end of the sheath of the penis roundly and broadly truncate. Glans penis biblobed posteriorly, with a terminal median piece which is shorter than the rest of the glans (figs. 249, 252-254, pl. XIX). Anterior end of the vesicle of the penis in ventral view broadly and roundly truncate, wider than the sheath of the penis. Genital lobe barely produced ventrad beyond the rest of the ventral margin of abdominal segment 2, with about 10 black denticles.

♀. Pale spots on abdominal segment 2 not different from those of the male.

Dimensions.—Total length ♂ 90, ♀ 100 mm., abdomen (excl. apps.) ♂ 60, ♀ 66-68, sup. apps. ♂ 6.30-7.00, ♀ 12.5-13, hind wing ♂ 55-58, ♀ 57-60, pterostigma, front wing, costal edge ♂ 4.83-5.48, ♀ 5.07-5.56 mm. Front wings with 18-22 antenodals, 9-12 postnodals, hind wings with 14-16 antenodals, 11-14 postnodals.

Ecology.—Without repeating here the many data on both imago and nymph given by Byers¹⁹ pages 253-255, we add the note by Hebard on the envelope of the Miami male, "pine woods".

Discussion.—Abnormalities in the venation of the left hind wing are presented in the male from Royal Palm State Park where a row of cells from the nodus to the hind wing margin is abnormal in size and in partial interruption of cross-veins, and in the female from the same locality where the proximal and distal sides of the discoidal triangle are angulated so as to form broken lines and the five cells within the triangle are irregularly arranged. *Ae. ingens* is the type of the genus *Coryphaeschna* of Williamson.⁵ Hagen²² comments on the very short appendages of the female of *Aeschna abbotti* Hagen, which he places³ as a synonym of *ingens*; there is some confusion here still to be cleared up; the few female appendages of *virens* which I have been able to examine, see postea, are also longer than those of *abbotti*. Martin¹⁰ says, "quatre rangs (de cellules) sous la fourche du sous-nodal"; Williamson⁵ page 7 gives them more exactly as, "4 to 8, usually 5". Martin¹⁰ says, "Côté intérieure des triangles discoidaux de moins de moitié aussi long que le côté extérieur"; Williamson again⁵ page 5 has it more exactly as, "not half as long as the outer side". For both these venational details see Williamson's⁵ and Needham's⁷ figures.

Coryphaeschna viriditas Tables 2, 5, 8, 12, 13, 18; Pl. XXXVII, figs. 500-504, Pl. XXXVIII, figs. 506-512; Map 7.

1952. *Coryphaeschna viriditas* Calvert, Ent. News 63: 264 (new name for *Aeschna virens* Rambur 1842 preoccupied).¹

1953. *Coryphaeschna viriditatis* Rácenis, Anales Univ. Centr. Venez. 35: 35.²

1842. *Aeschna virens* Rambur, Ins. Nevr. 193.³

1861. *Aeschna virens* Hagen, Synop. Neur. N. Amer. 127, 314.⁴

1865. *Aeschna virens* Scudder, Proc. Boston Soc. Nat. Hist. 10: 190.⁵

1867. *Aeschna virens* Hagen, Proc. Boston Soc. Nat. Hist. 11: 293.⁶

1867. *Aeschna virens* Uhler, Proc. Boston Soc. Nat. Hist. 11: 295.⁷

1873. *Aeschna virens* Hagen, Proc. Boston Soc. Nat. Hist. 15: 374.⁸

1874. *Aeschna virens* Hagen, Proc. Boston Soc. Nat. Hist. 16: 351.⁹

1875. *Aeschna virens* Hagen, Proc. Boston Soc. Nat. Hist. 18: 36, 38.¹⁰
 1886. *Aeschna virens* Gundlach, Neur. Cuba 238.¹¹
 1903. *Coryphaeschna virens* Calvert, Ent. News 14: 9.¹²
 1905. *Aeshna virens* Calvert, Biol. Centr.-Amer. Neur. 187, tab. viii, figs. 17, 18 (apps. ♂).¹³
 1908. *Aeschna virens* Martin, Colls. Zool. Selys-Longch. Cat. Syst. Descr. fasc. XVIII: 76, fig. 75 (apps. ♂).¹⁴
 1918. *Coryphaeschna virens* Ris, Arch. Naturgesch. 82 A (9): 169.¹⁵
 1919. *Aeshna virens* Calvert, Ent. News 30: 37.¹⁶
 1919. *Aeshna virens* Calvert, Trans. Amer. Ent. Soc. 45: 358.¹⁷
 1924. *Coryphaeschna virens* Navas, Mem. R. Acad. Cien y Artes Barcelona (3) 18 (13): 5.¹⁸
 1924. *Coryphaeschna virens* Navas, Rev. R. Acad. Cien. Exact. Fis. Nat. Madrid 21: 324.¹⁹
 1925. *Aeschna virens* Campos, Rev. Coll. Nac. Vic. Rocaf. 7 (19-20): 4.²⁰
 1929. *Coryphaeschna virens* Needham & Heywood, Hdbk. Drgfls. N. Amer. 132.²¹
 1932. *Coryphaeschna virens* Geijskes, Zool. Meded. Mus. Nat. Hist. Leiden 15 (1-2): 101.²²
 1939. *Coryphaeschna virens* Cowley, Mem. Mus. Roy. Hist. Nat. Belg. (2) 15: 147.²³
 1941. *Coryphaeschna virens* Westfall, Ent. News 52: 15.²⁴
 1943. *Coryphaeschna virens* Geijskes, Ent. News 54 (3): 63, 64, 68, figs. 2A-F (nymph).²⁵
 1948. *Coryphaeschna virens* Calvert, Zoologica 33 (2): 71.²⁶

Material studied.—U. S. AMERICA: Florida, Lower Matecumbe Key, March 20, 1938, M. J. Westfall, Jr., 1 ♀ Museum, Rollins College, Winter Park. WEST INDIES: Cuba, Loew 1 ♀ MCZ; Casa Villata, 22 July 1 ♂, Calabazar, 28 Aug. 1 ♂, 1 ♀ Playa del Chico, 4 Sep. 1 ♂, these three all near Habana, 1923, Santiago de las Vegas, 25 June to 16 Sep., 4 Dec., 1923-1926 3 ♂, 6 ♀, F. Z. Cervera, coll. Cowley; Isle of Pines, P. R. Uhler 1 ♂ and Hayti, Samana, Frazar 1 ♂, 1 ♀ MCZ; Jamaica, W. Schaus 1 ♀ USNM. MEXICO: Alta Mira, Tamaulipas, M. E. Hoag, June 30, July 15, 1903, 1 ♂, 1 ♀ coll. P. P. C. at ANSP; Atoyac, Vera Cruz, May, 2 ♂ and Teapa, Tabasco, Feb. 1 ♀ H. H. Smith, coll. Godman, Brit. Mus. Nat. Hist. BRITISH HONDURAS: Blancaneaux 1 ♀ same coll. & Mus. GUATEMALA: Cayuga, Sept. 5, Schaus & Barnes 1 ♀.¹⁶ COSTA RICA: Rio Diria, west of Santa Cruz, Guanacaste, Jan. 21, 1910, P. P. Calvert 1 ♂ ANSP. PANAMA: A. Agassiz 1 teneral ♀ MCZ; Trinidad 1 ♂ ex coll. Selys coll. P. P. C. ANSP. BRITISH GUIANA: Bartica District "Odon 22" W. Beebe 1 ♀²⁶ AMNH; River Supenaam, G. Brinsley 1 ♀ in alcohol coll. Needham. FRENCH GUIANA: Cayenne, Jan., 1904, W. Schaus 1 ♂ USNM. ECUADOR: Guayaquil 1 ♂, 1 ♀ and Loja, 2200 m. 1 ♀ F. Campos R. ANSP. PERU: Sivia, Rio Apurimac, Prov. La Mar, 13 Jun 1941, Woytk[owski] 1 teneral ♀ coll. Kennedy. BRAZIL: [Amazon?], Bates 1 ♀ ex coll. Selys, coll.

P. P. C. ANSP. PARAGUAY: Sapucay, 26.2.1900, W. T. Foster 1 ♀ USNM. Total 15 ♂, 23 ♀.

Distribution.—Florida Keys and Tamaulipas, Mexico, to Santa Cruz, Bolivia, and Chapada, Matto Grosso, Brazil; Cuba, Isle of Pines, Hayti, Jamaica, Trinidad.²² 23° North to 15° South Latitude, 57° to 100° West Longitude.

Altitudinal Range.—Sea level to 2200 m. (7218 ft.) in Ecuador.

Seasonal Range.—There are no records for April or November, the other ten months are represented in one or other locality; at Santiago de las Vegas, Cuba, four consecutive months are recorded for *virens*. May to October is the rainiest period of the year at Havana*. *C. viriditas* would appear to be an all-year species, independent of the seasons.

♂. For reasons similar to those given antea for *ingens*, the present account of *viriditas* is limited to features not, or but briefly, described by preceding authors. Line on the fronto-clypeal suture pale brown or black, the middle section of the curved groove on the upper part of the anterior surface of the frons is black in the Samana male. The transverse tubercle on the posterior half of the dorsum of abdominal segment 1 is .78 mm. high above the dorsum (which is .17 of the height of the segment) in the Alta Mira male. Teeth on the hind margin of the auricles of segment 2:3 (40%), 4 (50%) or 5 (10%) in five males tabulated; 5 teeth occur on the left auricle only of the Trinidad male, the right auricle having 4 teeth. The spines of the anterior lamina vary from .33 to 1.23 mm. in length; they are pale colored, except for their black tips which do not reach as far caudad as the level of the hind ends of the hamular processes. Hamular processes acutely pointed anteriorly, mesal margins parallel and closely approximated, the anterior portions largely dark-colored. Posterior hamules with a terminal row of pale brown hairs up to .74 mm. long. Genital lobe with no, or very minute, spinules. Glans penis with the terminal piece projecting beyond the level of the ventral median posterior lobe as drawn (figs. 500, 501, 504, pl. XXXVII), dorsal serrations visible for entire length of protruded part but those on its basal part concealed by the lateral lobe; apex of terminal piece truncated as shown in fig. 500, not bifid; when viewed in different positions in the same plane there seem to be additional serrations beyond those visible on the outline but not arranged in longitudinal lines (Guayaquil); in the Rio Diria male the terminal piece is not visible (lost or strongly retracted basad?), the ventral median posterior lobe widely open where the terminal piece projects in the Guayaquil male; the following varia-

*Kendrew, W. G., *Climates of the Continents*, Oxford Clarendon Press, 4th edit., 1953, p. 527.

tions were noted in the material from near Havana: terminal piece not projecting as far as the level of the ventral median posterior lobe but far enough to show its dorsal serrations in two longitudinal rows, one right, the other left, extending from the apex of the terminal piece almost to the level of the base of the glans, but could not make out whether the tip of the terminal piece is bifid or not (Playa del Chico); terminal piece projecting distinctly beyond the level of the ventral median posterior lobe, more slender than in Guayaquil male, no serrations visible on the protruded part but basad-directed serrations visible on its base, the slenderness of the terminal piece may be due to injury (Santiago de las Vegas); terminal piece (better seen on the right side) projecting not farther than the level of the apex of the lateral lobe of the glans, its serrations showing distinctly along its dorsal margin, perhaps in two longitudinal rows, right and left, but right not distinct, no apparent bifid condition at tip (Casa Villate); terminal piece projecting as far as the level of the apex of the lateral lobe, its serrations showing distinctly on its dorsal margin; viewed in different positions, but all in the same plane additional serrations seem to show arranged in a parallel longitudinal line; the tip of the terminal piece shows better from the right side than from the left and certainly gives no indication of a bifid condition (Calabazar). All these observations of the glans penis were made under objective 3 of a Leitz compound microscope.

Superior appendages longer than abdominal segments 9 + 10, not as long as 8 + 9.

♀. Differs from the male as follows: The Sapucay female has the face reddish, the upper surface of the frons pale bluish with faint indications, after application of 95% alcohol, of a reddish T-spot similar in shape to that shown in fig. 511, pl. XXXVIII; the Panama female has no superior mark on the frons; Loew's Cuban female has the transverse groove on the anterior surface of the frons filled with black; the Calabazar female has the top of the T-spot with arms a little more slender, the face greener, especially the labrum which has no orange, free margin of labrum and tips of mandibles blackish, as is also the case in Loew's female, brown on the distal parts of median and lateral lobes of labium. Black at postero-lateral angles of dorsum of abdominal segments 8 and 9 much less marked. The transverse, posterior, dorsal tubercle of abd. seg. 1 .41-.57 mm. high. No dorsal anterior scars on abdominal segment 9. Genitalia of 8 and 9 and anal appendages as shown in fig. 507, pl. XXXVIII; anal appendages, preserved in only five females, longer than abdominal segments 9 + 10, longer than 8 + 9 + 10, shorter than 7 + 8 + 9, maximum width .7-.9 mm. at .42-.48 of appendage length.

A female in Prof. Needham's collection labeled "C. Bolivar 4-x-40 Anduze", presumably Venezuela, has the abdomen (excluding the appendages, which are lost) 50 mm., hind wing 50 mm., a well-marked black T-spot on the frons, the frons superiorly green, anteriorly and the clypeus obscure bluish (?), labrum approaching orange its distal half black. I refer it to *viriditas* although it is not typical.

Dimensions.—Total length ♂ 80, ♀ 83 mm. Abdomen (excl. apps.) ♂ 51.5-58, ♀ 51-65, sup. apps. ♂ 5.40-6.63, ♀ 4.90-8.83, hind wing ♂ 50-56, ♀ 50-61.5, pterostigma, front wing, costal edge ♂ 4.36-5.48, ♀ 4.36-5.65 mm. Front wings with 18-29 antenodals, 10-15 postnodals. Hind wings with 13-19 antenodals, 11-19 postnodals.

Ecology.—Dr. Hoag wrote of the female he took at Alta Mira: "Fairly common but *very* hard to get. High flier. Open woods." Similarly Uhler:⁷ "I was unable to capture the only specimen that I saw, which was flying with great rapidity near the road along the River Grand-Anse [Hayti]. It once alighted on the limb of a tree within full sight, but beyond the reach of my net, and it appeared to me to be this species." The absence of the anal appendages from many females of this species, noted by Martin,¹⁴ is perhaps to be accounted for as F. X. Williams* has done for females of *Gynacantha nervosa*: "the long superior anal appendages broken . . . during oviposition, when these rather delicate processes are pushed against the soil while the slender sword-like ovipositor . . . is digging the egg cavity. The reared specimen had these superior anal appendages perfect . . ."

Coryphaeschna adnexa Tables 9, 12, 13, 19; Pl. I, XXXVII, fig. 505; Map 7.

1861. *Aeschna adnexa* Hagen, Synop. Neur. N. Amer.: 127.¹

1875. *Aeschna adnexa* Hagen, Proc. Boston Soc. Nat. Hist. 18: 35.²

1886. *Aeschna adnexa* Gundlach, Neur. Cuba: 237.³

1903. *Coryphaeschna adnexa* Calvert, Ent. News 14: 9.⁴

1905. *Aeschna adnexa* Calvert, Biol. Centr.-Amer. Neur. 188.⁵

1909. *Aeschna adnexa* Calvert, Ann. Carn. Mus. Pittsb. 6 (1): 222.⁶

1913. *Coryphaeschna adnexa* Ris, Mem. Soc. Ent. Belg. 22: 86.⁷

1918. *Coryphaeschna adnexa* Ris, Arch. Naturgesch. 82 A (9): 170.⁸

1919. *Aeschna adnexa* Calvert, Trans. Amer. Ent. Soc. 45: 357.⁹

1922. *Aeschna adnexa* Campos, Rev. Coleg. Nacio, Vic. Rocafuerte 1922 (8-9): 32, lam. 2, fig. 5 (♀).¹⁰

1922. *Coryphaeschna adnexa* Navás, Rev. Real Ac. Cien. Exact. Fis & Nat. Madrid XIX: 267.¹¹

1924. *Coryphaeschna adnexa* Navas, Rev. R. Acad. Cien. Exact. Fis. Nat. Madrid 21: 324.¹²

1927. *Aeschna adnexa* Campos, Rev. Coleg. Nacion. Vic. Rocafuerte 9 (30-31): 80.¹³

1931. *Aeschna adnexa* Campos, op. cit. 13 (44): 4.¹⁴

1932. *Coryphaeschna adnexa* Klots, N. York Acad. Sci., Sci. Surv. Porto Rico & Virg. Is. 14 (1): 20.¹⁵

* Pan-Pacific Entomologist 13 (1 & 2): 3, Jan. & April, 1937.

1932. *Coryphaeschna adnexa* Geijskes, Zool. Meded. Mus. Nat. Hist. Leiden 15: 101.¹⁶
 1934. *Coryphaeschna adnexa* Hincks, Ent. Rec. 15.vii.1934: 77.¹⁷
 1938. *Coryphaeschna adnexa* Garcia-Diaz, Jl. Agr. Univ. Puerto Rico 22 (1): 57, 75, 83.¹⁸
 1943. *Coryphaeschna adnexa* Whitehouse, Bull. Inst. Jamaica Sci. Ser. 3: 9.¹⁹
 1948. *Coryphaeschna adnexa* Wolcott, Jl. Agr. Univ. Puerto Rico 32 (1): 80.²⁰
 1953. *Coryphaeschna adnexa* Rácenis, Anales Univ. Centr. Venez. 35: 38.²¹
 1955. *Coryphaeschna adnexa* Needham & Westfall, Man. Drgfls. N. Amer.: 280.²²
 1865. *Aeschna macromia* Brauer, Verhd. zool.-bot. Gesel. Wien 15: 906.²³
 1867. *Aeschna macromia* Brauer, Reise Novara Neur. 68: tab. 1, fig. 18 (apps. ♂).²⁴
 1867. *Aeschna macromia* Hagen, Verhd. zool.-bot. Gesel. Wien 17 (49).²⁵
 1899. *Aeschna macromia* Calvert, Proc. Calif. Ac. Sci. (3) Zool. 1: 387.²⁶

Material studied.—CUBA: 1 ♀ MCZ, Rio Almendares, tropical, Habana, 3 June 1924 1 ♀; Santiago de las Vegas, Habana, 29 May, July 10 to Sept. 2, 6 Dec., 1923-5, F. Z. Cervera, 9 ♂, 2 ♀ coll. Cowley; Pinar del Rio, Br. Robert 1 ♂, 1 ♀ coll. Needham; Guantanamo, S. Carlos Hacienda, II.3.14 1 ♂ H. Skinner ANSP. HAYTI: Dec. 3, 1897, R. J. Crew 1 ♂ coll. C. C. Adams; Samana, Frazer 1 ♂ MCZ. PORTO RICO: Rio Piedras, south of hill where aqueduct is, iii.24-30 1 ♂ coll. Needham. San Domingo ex coll. Selys 1 ♂ coll. P.P.C. MEXICO: Alta Mira, Tamaul., June 24, 1903, M. E. Hoag 1 ♂ coll. P.P.C.; Teapa, Tabasco, Feb., H. H. Smith 1 ♂, 2 ♀ coll. Godman. Brit. Mus. GUATEMALA: Gualan, Dept. Zacapa, June 15, 1909, E. B. Williamson 1 ♂ coll. P.P.C. HONDURAS: S. Pedro Sula, Frühstorfer 1 ♂ coll. McLachlan, Brit. Mus. Nat. Hist. COSTA RICA: Matambu, Guanacaste, Feb. 1912, 1 ♂ and Nicoya 1 ♂ J. F. Tristan coll. P.P.C. PANAMA: Summit Gardens, 9/1/50, R. B. Cumming, Univ. Florida 1 ♂; Canal Zone, Albbrook Field, Oct. 19, 1937, Raymond Bliss 1 ♀ coll. P.P.C. SURINAM: Paramaribo weg u zie (Kwatta), 6 Nov. 1938, D. C. Geijskes 1 ♂ coll. P.P.C. ECUADOR: Tena, region oriental, 500 m. Agosto 1 ♀, Casiguana, May, 1904 1 ♂, Guayaquil, March 1 ♂, 3 ♀, and S. Rafael, 200 m. 1 ♀ all F. Campos R., coll. P.P.C. BRAZIL: Manaos, June 8, 1922, J. H. Williamson & J. W. Strohm 1 ♀, abd. segs. 6-10 cut off by stroke of the net; Peixe Boi, [Para], Nov. 30, 1907, H[arriet] B. Merrill 1 ♀ and [Amazons] Bates 1 ♂ ex coll. Selys all three coll. P.P.C.; Chapada 1 ♀ MCZ; near Rio, 7 March, 1925, F. M. Root 1 ♂ coll. Needham. ARGENTINA: Manantiales [Corrientes], Nov., 1946, Th. de Apostol [Lat. 27 58 S. Long. 58 8 W. alt. 1-100 m. Hisp. Amer. map, Amer. Geog. Soc. N. York], 1 ♀ coll. F. C. Fraser. Total 27 ♂, 17 ♀.

Distribution.—Cuba to Porto Rico and Jamaica, Tamaulip., Mexico, to Venezuela,²¹ Ecuador, Peru¹¹ and Corrientes, Argentina. Latitude 23° N. to 28° S., Longitude 43° to 98° W.

Altitudinal Range.—Sea level to 200 m. (656 ft.) in Ecuador.

Seasonal Range.—Every month in the year is represented in one or another locality. Like *C. viriditas*, *adnexa* appears to be an all-year species, independent of the seasons.

♂. The following description is based on four males, one each from Santiago de las Vegas, Gualan, Guayaquil and Peixe Boi. Face pale blue, bluish green or greenish blue, the superior groove on the anterior surface of frons filled with brown ochre or black, a brown line on the fronto-clypeal suture, a median vertical blackish or brown line on the anteclypeus (rhinarium), absent from the Guayaquil male, a brown line in the clypeo-labral suture, absent from the Guayaquil male, apices of the mandibles black; stem of the black or dark brown T-spot confluent with a transverse stripe of the same color in front of the eyes, widening cephalad, extending over the anterior frontal carina into the superior groove on the anterior surface of the frons, lateral ends of this carina pale brown; superior surface of frons on each side of the stem of the T-spot green or greenish yellow extending down on each side of the frons to meet the blue or greenish blue thereof. Free margin of labrum narrowly brown. Labium pale blue, yellow or pink, distal margin of median and lateral lobes brown. Vertex dark cologne earth to black with a transverse green stripe, lateral ocelli yellow to orange. Occiput yellow or blue, edged with black. Rear of eyes (genae) yellowish blue, almost black superiorly.

Pronotum dark indian red, hind margin convex, not bifid, with a row of erect pale hairs; median lobe bilobed anteriorly, anterior lobe margined anteriorly with darker brown; propleura pale yellow.

Pterothorax green, lines or narrow stripes on each side of the mid-dorsal carina, on the humeral and second lateral sutures and on the margins of the metastigma brown.

Bases of the legs reddish brown, first femora blue inferiorly, tibiae and tarsi black.

Abdomen dark indian red to almost black; segment 1 with a ventral cluster of spinules near the hind margin, not on a tubercle but presumably represent the spinulose tubercle of *Aeshna* species; posterior half of dorsum with a roundly elevated tubercle .4 mm. high, equal to about .1 of the height of the segment, each side of 1 and of base of 2 with a tuft of pale hairs. Pale markings as follows: most of 1 and of the sides of 2 green, pale green MD on 3-8, pale green PD on 3-9, green AL on 3-7 or -9 becoming smaller caudad, MD, PD and AL in the form of transverse stripes, sides of 9 posteriorly and of 10 reddish; a mid-dorsal, narrow, longitudinal stripe on 3-8, confluent with MD and PD.

Auricles of segment 2 with 2 teeth on the hind margin (3, the lateralmost smallest, in the Gualan male). Anterior lamina pale brown, the black or dark brown tips of its spines reaching caudad not nearly as far as the level of the hind margin of the hamular processes. Hamular processes dark brown, anterior end sharply pointed, hind end rounded. Sheath of penis convex at hind end. Genital lobe with 4-8 black denticles. Posterior hamules pale reddish with pale reddish hairs at apex.

The following variations were observed in the penis of five Cuban and one Guayaquil male, examined under objective 3 of a Leitz compound microscope: in the Guantanamo male apex of terminal piece shown in our figs. 6 and 10, pl. I, is rounded with no trace of a bilateral condition, width .07 mm. as compared with the same dimension, ca. .09 mm. of *viriditas* and no denticles visible; the basal $\frac{3}{4}$ however, is clearly bifid and with fine bristles slanting basad on the concave ventral edge at mid-length. The Guayaquil male closely resembles the figures cited but differs in that the terminal piece is distinctly bifid, the bifid condition being traceable, in profile view, for at least the distal half of the length of the terminal piece but showing no denticles; in dorsal view only the extreme apex of the terminal piece can be seen, most of the piece being concealed by the glans, but the apex is distinctly bifid, the two divisions lying near together. The Santiago de las Vegas male of Aug. 3 has the two halves of the terminal piece separate from each other for their entire length, apex to base, in profile view; no denticles, but with a row of close-set bristles, slanting basad, on the concave ventral margin of each half in profile view; the extreme tip of each half is hooked dorsad. The Santiago male of July 17 is similar to that of Aug. 3 including the row of bristles slanting basad on both halves, but the tip of the left half is hardly curved, of the right half curved slightly ventrad, not hooked, fig. 505, pl. XXXVII. The Santiago male of July 21 is similar to that of July 17, the tips of both halves curved slightly dorsad, not hooked. The Santiago male of Aug. 20 similar to that of July 21, tips of both halves curved slightly dorsad, not hooked; row of bristles visible on convex dorsal side of left half, less marked on concave ventral edge; visible on concave edge of right half but not as distinct on convex edge of the right half.

These individual differences in penes are in part due to paired parts adhering to each other, perhaps by the action of the seminal fluid drying and holding them together. They afford some means of distinguishing between actual differences and occasional temporary conditions, the differences where paired parts are separate, as in fig. 505, pl. XXXVII, and also in the male of Aug. 3, being specific characters.

Abdominal segments 9 and 10 finely longitudinally striolate mid-dorsally and a pair of dorsal pits near the anterior margin laterad to the striulations.

Superior appendages longer than segments 9 + 10, shorter than 8 + 9, vandyke brown; in dorsal view narrowly contracted on the mesal side in the basal fifth to third, thence expanding to a width of .9-1.06 mm. at .4-.53 of the appendage length, thence gradually narrowing to the rounded apex, a submedian longitudinal carina, burnt sienna in color, whose width decreases distad;

in profile view upper margin concave as far as the terminal .18-.33 of the appendage length, where the arched superior carina appears and continues to the rounded apex, lower margin concave to .25-.3 of appendage length, where is a rounded inferior angle, thence the lower margin slightly convex to the terminal .25-.36 of the appendage length where it passes beneath the lateral margin of the appendage.

Inferior appendage reaching to .375-.42 of the length of the superiors, in profile view its upper margin concave but angulated at or near half its own length, the terminal half directed horizontally or upward; in ventral or dorsal view triangular, more contracted in its distal half in the Samana and Peixe Boi males.

Wings uncolored, or slightly smoky in the middle third or throughout, venation brown, costa more often paler to beyond the nodus; stigma surmounting 2 + to 3 + cells, dragons blood, burnt sienna or pale brown above, brown, brown ochre or paler below; membranule cinereous throughout.

♀. Description based on five females, one each from Santiago de las Vegas, Albrook Field, San Rafael, Guayaquil and Manantiales; they differ from the male as follows: superior groove on the anterior surface of the frons filled with brown, no dark median vertical line on the ante-clypeus, dark line in the clypeo-labral suture present or absent; stem of the T-spot on the upper surface of the frons pale reddish brown (S. Rafael) or dark brown, shaped as in the male, anterior frontal carina pale brown or greenish, superior surface of frons on each side of the stem greenish blue in the Santiago female; labium yellow, bluish on the median lobe (Manantiales), no brown on the distal margins (Santiago, S. Rafael); vertex roman sepia with a transverse green stripe, or this broken into two spots, one at each end, or stripe absent (S. Rafael). Pronotum pale bluish (?) (S. Rafael); propleura pale bluish (?). Brown lines or stripes on pterothorax less marked; the Santiago female has a hint of a brown antehumeral stripe nearer to the humeral suture than to the mid-dorsal carina. Tibiae dark brown or almost black. Abdomen pale brown ochre or roman sepia, a little darker on the dorsum of 3-7 or 3-8, the pale markings are faded, most distinct are MD on 3-7 and PD on 3-6 or -7, sides of 9 and of 10 reddish, yellowish or pale brown ochre.

Segments 9 and 10 with dorsal striolations and pits as in the male; in the females the posterior half of these striolations on segment 10 lie in a semi-circular area whose diameter is at the hind margin of the segment and which is bounded, right and left, by a curved carina and on each side of the striolations is an oval pit whose longitudinal diameter is longer than the transverse diameter; it may be that these structures take some part in the pairing of the sexes.

On segment 10 of *C. viriditas* the mid-dorsal striolations do not lie in a semicircular area, the curved right and left carinae which bound this area in *adnexa* being absent, incomplete, or represented by 2-3 parallel curved striations on each side.

The genitalia of segments 8 and 9 are shown in figs. 8 and 9, pl. I. The spinules on the ventral surface of 10 vary from 26 to 48 in number; in *viriditas* from 28 to 55. The appendages of all the females of *adnexa* are lost; see the remarks on this subject under *viriditas*, antea, page 166.

Wings uncolored (Manantiales), or barely yellowish from base to internal triangle, or between nodus and stigma, stigma surmounting as much as four cells in one wing of S. Rafael female, varying from pale brown ochre to almost clay yellow.

Dimensions.—Total length ♂ 65, ♀ 70 mm. Abdomen (excl. apps.) ♂ 43-48, ♀ 46-52, sup. apps. ♂ 5.25-6.38, ♀ 7.36, hind wing ♂ 40-43, ♀ 41-45, stigma, front wing, costal edge ♂ 3.60-4.17, ♀ 3.76-4.42 mm. Front wings with 17-21 antenodals, 9-12 postnodals, hind wings with 12-15 antenodals, 11-14 postnodals.

Living colors.—A slip within the envelope of the Peixe Boi male reads "Face, mandibles, lip, back of eyes sky blue, sides of thorax moss green with brown lines, base of ab. black with green lines."

Ecology.—On the envelope of the Paramaribo male Dr. Geijskes wrote: "over pool near road in the morning 10 o'cl. flying in the sun." Prof. Campos wrote¹⁰ of this species as inhabiting marshy places and¹⁴ that a female entered a room in the night of Dec. 30, 1929, and alighted on an electric light. On the envelope of the Manaos female J. H. Williamson wrote: "Saw several *Coryphaeschnas* but got only one swipe as this ♀ cruised along the road."

- Coryphaeschna perrensi*** Tables 2, 5, 9, 12, 13, 19; Pl. XXX; Map 7.
 1887. *Aeschna perrensi* McLachlan, Ent. Mo. Mag. 24: 76.¹
 1905. *Aeshna perrensi* Calvert, Biol. Centr.-Amer. Neur.: 182, 188, tab. viii, figs. 26, 27 (apps. ♂).²
 1907. *Aeschna perrensi* Foerster, Ent. Wochenbl. (Insekten-Borse) 24 (37): 163.³
 1908. *Aeschna perrensi* Martin, Colls. Zool. Selys-Longch. fasc. 18: 74, fig. 73 (apps. ♂).⁴
 1913. *Coryphaeschna perrensi* Ris, Mem. Soc. Ent. Belg. 22: 86.⁵
 1923. *Coryphaeschna perrensi* Navas, Arxius Inst. Cien. Barcelona 7: 181.⁶
 1924. *Coryphaeschna perrensi* Navas, Estudios, Buenos Aires, Mayo de 1922, p. 358.⁷
 1930. *Coryphaeschna perrensi* Navas, Rev. Soc. Ent. Argent. 1930 (13): 125.⁸
 1933. *Aeschna perrensi* Navas, Rev. Acad. Cien. Madrid 29: 54.⁹

Material studied.—MEXICO: Atoyac in Vera Cruz, H. H. Smith, April 1 ♂ May 1 ♂ coll. Godman, Brit. Mus. Nat. Hist. PANAMA: Canal Zone, Theodor Zschokke, 1 ♂ coll. Needham; Gatun 1 ♂ USNM; Gatun River, 1 mile up from TIH bridge 8/27/50 1 ♂; Summit Gardens 9/1/50 1 ♂; BC lake in front

of lab. 7/23/50 1 ♂, the last three males by Robert B. Cumming in his coll.; Ft. Kobbe, sunny opening in jungle stream, Jan. 9, 1938, Raymond Q. Bliss 1 ♂ coll. PPC. PERU: Balsapuerto, G. G. Klug, Mar. 1936, May 1935, 2 ♂ coll. Cowley. BRAZIL: Minas Geraes 1 ♂ with label "Aeschna rufina" in Hagen's hand MCZ; Lagoa Santa, Minas Geraes 2-47 Santos Berla Machado 1 ♂ coll. Dias dos Santos; [Rio] 1 ♂ with two labels, both in de Selys' hand "P. Br." and "Ae. erythroneura" MCZ; Ypiranga [probably in the State of Paraná]. A. Hempel, 17 March 1898 1 ♂ coll. Needham; Nova Teutonia, Santa Catharina, 20 Feb., 1935, F. Plaumann 1 ♂ coll. P.P.C.; Rio Grande do Sul, H. H. Smith 1 ♀ MCZ. PARAGUAY: Sapucay, 9-3-03 1 ♂, 12-2-03 1 ♂ W. T. Foster coll. ANSP. Total 16 ♂, 1 ♀.

Distribution.—Vera Cruz, Mexico, to Balsapuerto in Peru, to Rio Grande do Sul in Brazil and Goya,¹ Corrientes, Argentina; 19° N. Lat. to 29° S. Lat., 43° to 97° West Long.

Altitudinal Range.—Sea level to 400 m. (1315 ft. at Atoyac *) or higher?

Seasonal Range.—All months except October and November are represented at one or another locality above cited, but there is no long series of dates for the same place. The nearest approach to such a series is for the Canal Zone, Panama, namely Jan., July, Aug. and Sept. The rainy season in the Canal Zone is from April to December (Balboa Heights) or to January (Colon); the rainiest month at Balboa Heights is October, at Colon November; the driest month at Balboa Heights or Colon February or March.† In the Canal Zone, therefore, *C. perrensi* is a rainy season species. Balsapuerto, Peru, and Ypiranga, Brazil, lying east of the Andes at elevations below 1000 m. (3280 ft.) are apparently similar in rainfall to Iquitos, Brazil, where the driest month (August) has a precipitation of 4.61 inches, "so that there is no dry season";‡ *perrensi* here also is a rainy season species. In southeastern Brazil Lagoa Santa and Nova Teutonia presumably resemble Rio de Janeiro and Sao Paulo in having November or December to March the rainier months; *perrensi* is a wet season species here.

* Gannett, H., A List of Altitudes in Mexico and Central and South America, Month. Bull. Internat. Bur. Amer. Repubs. Sept., 1904, Wash., D. C., p. 9.

† Reed, W. W., The Climates of the World, Yearbook of Agriculture 1941, U. S. Dept. Agric. Wash., p. 673, cf. p. 1224.

‡ Kendrew, W. G., The Climates of the Continents, Oxford at the Clarendon Press, 4th edit., 1953, p. 495.

If Sapucay is like Asunción, October to May * are rainier months and *perrensi* occurs at the end of the dry season (September) and in the wet (December). At Atoyac, in Vera Cruz, *perrensi* appears in the dry season, if we may use the rainfall figures for the city of Vera Cruz.†

♂. Generally red in color without green markings on thorax and abdomen, except that the Rio male has traces of MD on 3-8, of PD on 3-5; no brown on the red frons, no superior T-spot, vertex reddish, not black, posteriorly dark brown to black, third femora reddish throughout except for the two inferior rows of black-tipped spinules. Posterior half of dorsum of abd. seg. 1 elevated as a rounded transverse tubercle to a height of .41-.74 mm. above the anterior part of the segment, this elevation corresponding to .09-.16 of the height of the anterior half of the segment; no ventral piliferous tubercle (or this very low, Fort Kobbe) on seg. 1 but a ventral group of small spinules represents this tubercle of *Aeshna*. Of ten males tabulated, 5 have three teeth on the hind margin of the auricles of seg. 2 on both sides, 2 have four teeth on both sides, 1 has four teeth on one side and three on the other, one has two teeth on one side and three on the other; the percentages of the numbers of teeth are 3 teeth 65%, 4 teeth 25%, 2 teeth 10%. Where four teeth occur and in one case where three teeth exist, the lateralmost tooth is much smaller than the others. A mid-dorsal longitudinal carina on segs. 3-9, more feeble on 9 in some. Dorsum of 10 with a pair of subcircular or elliptical pits near the anterior margin and near the mid-dorsal line and a low tubercle near each pit; some fine longitudinal striolations in the mid-dorsal region of the posterior half or more of the segment's length; more regular fine transverse striolations on the posterior half of the dorsum.

Details of the genitalia of seg. 2 were measured in the Lagoa Santa male and in one male from Sapucay (12-2-03) as follows, the first figure in each case being that of the Lagoa Santa example: total ventral length of the spine of the anterior lamina 1.55 mm., 1.23 mm., length of the free distal part .57 mm., .49 mm.; hamular process .82 mm., .80 mm., long, maximum width of the two hamular processes together .57 mm., .57 mm.; spines of the lamina projecting markedly ventrad in profile view (Ft. Kobbe, Ypiranga, Nova Teutonia and one Sapucay 9-3-03), their dark tips reaching caudad not as far as the level of the hind margins of the hamular processes and without a basal tuft of hairs. Genital lobe with very minute spinules (\pm .013 mm. long). Glans penis notched at apex, no median projection, no cornua.

* Reed, W. W., 1941, *op. cit.*, pp. 674, 675. Hann's precipitation figures for Blumenau, in the eastern part of Sta. Catharina are somewhat different, Meteor. Ztsch. XXVIII: 324, 1911.

† Kendrew, W. G., 1953, *op. cit.*, p. 527.

Superior appendages longer than abd. segs. 9 + 10, shorter than 8 + 9, in dorsal view with the lateral margin barely convex, almost straight, mesal margin concave in the basal seventh to third, convex for the remainder of its length to the rounded apex which may be slightly angular at its lateral angle, a superior, submedian, longitudinal carina; in profile view upper (= lateral margin of the dorsal view) margin almost straight, not sinuate, lower margin concave in the basal third, convex for the remainder of its length to the somewhat rounded apex. Maximum width of each superior appendage (five males measured) .94-1.06 mm. at .56-.66 of appendage length. In 1905² p. 188 I stated: "One of the Mexican (Atoyac) specimens has a small subbasal inferior tubercle on the superior appendages, in the other (the one we have figured) this tubercle is rudimentary; in most of the South-American material before me this tubercle is entirely absent, but a rudiment is present in three of the Paraguayan males, placed a trifle more posteriorly than in the Mexican examples." The two Atoyac males are not available for reexamination. All ten of the present males show this tubercle, although it is very small in some; it is best seen in an oblique-lateral view.

Inferior appendage reaching to the level of .52-.62 of the length of the superiors, in dorsal or ventral view triangular.

Wings smoky throughout (faintly, N. Teutonia) or uncolored except for pale yellow at base almost to arculus (Ypiranga), veins in the proximal half, or somewhat more, reddish, many cross-veins (in submedian space, in triangles, antenodals) bordered with gamboge or cadmium yellow (Balsapuerto, Ft. Kobbe, one Sapucay). Stigma brown ochre above, cadmium yellow below. Membranule cinereous. Rs forks nearer to the level of the mid-length of the stigma than to that of its proximal end.

♀. The female from Rio Grande do Sul may have had the pterothorax green dorsally in life. There are traces of the following green spots on the abdomen: AD on seg. 6, MD on 3-8, PD on 5-8; 9 and 10 mostly pale greenish or reddish dorsally, a transverse brown band occupying the most anterior fourth of 9 and most anterior fifth of 10. Appendages broken.

Dimensions.—Total length ♂ 70 mm. Abdomen (excl. apps.) ♂ 47-51, ♀ 52, super. apps. ♂ 5.36-5.89, hind wing ♂ 48-50, ♂ 52, pterostigma, front wing, costal edge ♂ 4.42-4.83, ♀ 5.45. Front wings with 19-24 antenodals, 10-13 postnodals, hind wings with 13-16 antenodals, 13-15 postnodals.

Ecology.—Ris⁵ quotes J[oergensen] who collected this species in Misiones, as noting it to be (translated) abundant, flies so swiftly and high that it is very difficult to catch.

Mr. Robert B. Cumming wrote from the University of Florida on July 11, 1952, to the author as follows: "This note is in response to your questions concerning the *Coryphaeschna* specimens I sent you from Panama. The specimens labeled 'Summit Gardens' (1 C. per-

rensi and 1 *C. adnexa*) are from the Canal Zone Experimental Gardens at Summit, Canal Zone. This is located right at the continental divide. There is small man-made lily pond at Summit Gardens around which are many Odonates of many species. On all of my trips to Summit Gardens I saw both *C. perrensi* and *C. adnexa*, but only a few specimens of each species, cruising around this pond at fairly high altitudes. The specimen labeled 'Gatun River 1 mile up from TIH bridge' was taken on the Gatun River 1 mile upstream from the Transmission Highway bridge. It will take a fairly recent map to show this location very exactly, as the highway was built during the war. Two rivers, the Rio Gatun and the Rio Agua Clara, meet right at this point (the bridge). At the place where the specimen was taken, the river has become very rapid and rather shallow, but is still a pretty good sized stream. *C. perrensi* was on that day extremely abundant there—they flew in large clouds at about tree top level or higher. Occasionally one would skim along the water past our cayuko, giving us a better look. I saw no other species on the river at this point but there were many species farther down stream. The single specimen I caught was one of the low fliers which came within net range. All of my specimens labeled "B. C." and "B. C. I." come from Barro Colorado Island, Canal Zone (The Canal Zone Biological Area). The notation 'lake in front of lab' refers to Gatun Lake along the shores of the island on the same (east) side of the island as the laboratory buildings. Occasionally a specimen of *C. perrensi* was seen flying low in this area and one was caught. I am sure that I have seen *C. adnexa* here too but none were caught. The exuvia was taken from vegetation sticking from the water of a small rain pond about 100 feet above lake level (Gatun Lake) on the north-west part of the island, on July 22, 1950. No *Coryphaeschna* of any kind were taken (or seen) near this pond, but there were many *Gynacantha tibiata* and *Triacanthagyna satyrus* about, and several specimens of each were taken."

Discussion.—The male in the MCZ with two labels by de Selys is probably from the State of Rio, Brazil, and the label "P. B." probably refers to Paul de Borchgrave, nephew of de Selys, who was minister of Belgium to Brazil, where he collected some Odonata and gave them to de Selys on his return to Europe. De Borchgrave collected at "Tijuca près de Rio Janeiro" and at "Nouvelle Fribourg", if not

elsewhere. Nova Friburgo, in the Brazilian spelling, is shown in the State of Rio in several maps. (Selys, 2ndes Addit. Synop. Calopt. pp. 3, 15, 1869; Bull. Acad. Roy. Belg. -2-27; 647, 659, juin, 1869; 2ndes Addit. Synop. Gomph., p. 30, 1869; Bull. Acad. Roy. Belg. -2-28: 193, aout, 1869.)*

* This interpretation of the Selysian label "P. B." applies also, I believe, to the label on a male of *Epigomphus paludosus* cited by Fraser in Ann. Ent. Soc. Amer. 40: 672, 1947, but I reject his interpretation that "P. B. in all probability refers to P. Beschke [sic], the collector of the type mentioned in the Mon. Gomph." for these reasons: The Monog. Gomph., p. 86, says of *E. paludosus* (translated): Described from the female type of the collection of M. Hagen, taken in Brazil by Beschke. Walther Horn, Über den Verbleib der entomologischen Sammlungen der Welt, Supplementa Entomologica No. 12, 15 März, 1926, p. 23 has, "Beschke, C. C., Sammler (bes. in Süd-Afrika u. Süd-Amerika) Ausbeuten vereinzelt." Walther Horn, Nachträge und Verbesserungen zu meiner Arbeit Über den Verbleib &c., Suppl. Ent. No. 17, 5 Feb., 1929, p. 80: "Beschke, C. C., recte C. H. Zeitweise alle Ausbeuten an M. Sommer (Altona) welcher die I. Auswahl behielt u. Dupla 1830-1833 vereinzelt." Horn, Walther u. Kahle, Ilse unter Mitarbeit von R. Korschefsky, Über entomologische Sammlungen, Ent. Beihefte aus Berlin-Dahlem Bd. 2-4, Dez., 1935-Aug., 1937, p. 17 say: "Beschke (Beske), C. F. C. (sen.), Ausbeuten aus Brasilien, spec. Rio (schon vor 1832!), ex parte direkt (z. B. Mus. Berlin, Halle, Hamburg, Stockholm, etc.), ex parte via M. C. Sommer vereinzelt.", "zu fügen: Ostafrika 1836/38" p. 320, "Beschke (Beske), Carl Heinrich (jr.) Ausbeuten aus West-Afrika (ab 1832!) u. Brasilien (1834/35) ex parte direkt (z. B. Mus. Berlin, Halle, Hamburg, Stockholm, etc.), ex parte via M. C. Sommer vereinzelt." p. 18. As appears from these quotations from Horn and Horn & Kahle, two Beschkes (senior, C. F. C., and junior, Carl Heinrich), neither of whom had a P as the initial letter of his name, collected in Brazil in 1830-1833. De Selys published the description of Beschke's female of *Epigomphus paludosus* in 1858 (Mon. Gomph., p. 86). Borchgrave's collection at Tijuca was probably made in the 1860s, possibly thirty years after Beschke's collections in the State of Rio. It is therefore, evident that the Tijuca female in the Selys collection can not be the type of *paludosus*. It is more likely that Hagen retained Beschke's female in his own collection. I accordingly wrote to Dr. P. J. Darlington, Jr., of the Museum of Comparative Zoology on February 15, 1955: "Can you tell me whether the type of *Epigomphus paludosus* Hagen (Odonata) is at the MCZ? and if so what labels it bears? It should have label(s) indicating that it was collected by Beschke, or Bescke, and perhaps "Rio" or "Brazil". It was in Hagen's collection according to the Monographie des Gomphines by deSelys-Longchamps and Hagen, 1858, page 86."

Dr. Darlington kindly replied as follows, under date of February 25, 1955: "In answer to your letter I can say that I find only one male, in poor condition, standing under the label *Epigomphus paludosus* Hagen. This specimen bears four separate small labels: "54", "Hagen", "Type No. 12370" and "*Epigomphus paludosus*?". Although this specimen has been labeled as a type, probably by Henshaw or Banks, I doubt if it is one. The ? after the name on the specimen makes me doubt it. If the original type was a female, it is not here."

The American Geographical Society's (New York) Millionth map of Hispanic America, sheet SF 23, shows Nova Friburgo in the State of Rio de Janeiro and La Tijuca in the immediately adjoining Distrito Federal on the west.

Genus **CASTORAESCHNA**

1952. *Castoraeschna* Calvert, Ent. News 63 (10): 264 (generotype *Aeschna castor* Brauer 1865).¹

1918. *Coryphaeschna* (in part) Ris, Archiv. Naturgesch. 82 (A9): 169.²

1943. *Coryphaeschna* (in part) Geijskes, Ent. News 54 (3): 61-64.³

Generic diagnosis.—Subnodal sector (Rs) forking at the level of from $\frac{1}{2}$ to 3 postnodal cells proximal to the stigma, or more rarely at the level of the proximal end of the stigma, with 3, 4, or rarely 2 rows of cells between the fork at the level of the distal end of the stigma; proximal side of the discoidal triangle of the hind wings always less (shorter) than half the hind (posterior) side; abdominal segment 1 with a ventral tubercle bearing spinules, or hairs, or both; males with the two ventral posterior angles of the tergum of abd. seg. 1 each prolonged into an acute, mesad-projecting tooth, hind wings with the anal triangle 2-celled.

A key to the species of *Castoraeschna* is given antea, page 16.

Description of features common to the following five species of this genus in addition to those given above under diagnosis and not repeated in the specific descriptions. Frons and postclypeus anteriorly rugulose, vertex black, occiput pale blue, its lateral angles black, rear of eyes cologne earth to black, yellow along the eye margins. Pronotum dark brown, hind margin of its hind lobe convex, with a row of erect pale hairs 1.64 mm. long, propleura pale brown. A separate greenish blue spot in the mesothoracic antealar sinus, some of the interalar sclerites blue. First femora reddish superiorly, black inferiorly, second and third femora throughout reddish, all tibiae and tarsi blackish throughout. A posterior transverse dorsal tubercle on abd. seg. 1. Pale spots (green in life): MD on segs. 3-7, PD on 3-9, AL on 3-8; 10 green on dorsum and sides in more than the posterior half, a low mid-dorsal longitudinal carina, a pair of shallow pits near the anterior margin, one on each side of the carina, some fine longitudinal striolations in the middorsal area, fine transverse striolations on more than the posterior half. Males with the lateral margins of the genital fossa not denticulated, superior appendages longer than segs. 9 + 10. Females with the anal appendages longer than the 11th tergum between them, sternum of 10 concave anteriorly, posteriorly with many black-tipped spinules, slightly curved mesad, directed caudad, grouped into two bilaterally symmetrical areas, ovipositor finely serrulate laterally, it and the genital valves reaching caudad to beyond the level of the hind margin of the tergum of 9, lateral genital valves reaching caudad to about the level of mid-length of the tergum of 9.

Castoraeschna januaria Tables 2, 4, 5, 9, 12, 13, 19; Pls. XXII, XXIII, figs. 294-296; Map 4.

1855. *Aeschna januaria* Hagen, in Schiodte & Hagen, Overs. Dansk. Vid. Selsk. Forhd. 1855: 125.¹ (No description.)
 1867. *Aeschna januaria* Hagen, Verhdl. Zool.-Bot. Gesel. Wien 17: 51.²
 1875. *Aeschna januaria* Hagen, Proc. Boston Soc. Nat. Hist. 18: 40.³
 1907. *Aeschna januaria* Foerster, Ent. Wochenbl. (Insekten-Borse) 24 (37): 163.⁴
 1908. *Aeschna januaria* Martin, Colls. Zool. Selys-Longchps. fasc. 18 60, fig. 56 (apps. ♂).⁵
 1916. *Aeshna januaria* Navas, Broteria, Ser. Zool. 14 (1): 17.⁶
 1924. *Aeshna januaria* Navas, Mem. R. Acad. Cien. y Artes, Barcelona (3) 18 (13): 5.⁷
 1929. *Coryphaeschna januaria* Kimmins, Ann. Mag. Nat. Hist. (10) 3: 491 fig. 1B (this fig. is like *januaria* but his other two figs., 1E, 2B, are not this species, see the discussion, postea).⁸
 1952. *Castoraeschna januaria* Calvert, Ent. News 63: 264.⁹
 1861. *Aeschna faunaria* Hagen, Synop. Neur. N. Amer.: 315.¹⁰ (Apparently a typographical error.)

Material studied.—BRAZIL: Lagoa Santa, Minas Geraes, Lagoa Olho d'Agua, 20.4.1949, Machado, coll. dos Santos 1 ♂ no. 12,479; Nova Teutonia, Santa Catharina, F. Plaumann, Nov. 20, 1934, 1 ♂, 1 ♀, Dez. 1, 1935, 1 ♂, Dez. 8-16, 1934, 3 ♂, Jan. 10, 193[6?] 2 ♂ colls. St. Quentin, PPC. PARAGUAY: Sapucay, W. T. Foster, 26.2.900. 1 ♀, 9.3.1903 2 ♂ USNM. Total 10 ♂, 2 ♀.

Distribution.—Mexico⁵ to Sapucay, Paraguay.⁴ 20°(?) N. to 27° S. Lat., 55°-100°(?) W. Long.

Altitudinal Range.—Sea-level to 500 m. (1640 ft.) at Nova Teutonia (see anteà, page 85).

Seasonal Range.—November to May.⁶ These summer months in Brazil below 20° S. have "far more rain than the winter, and summer and autumn are the rainiest seasons".*

♂. Description based chiefly, but not exclusively, on two males from Nova Teutonia and one from Sapucay. Face pale cadmium yellow. Frons superiorly with the barest trace of brown along the anterior margin and in front of the antennae and vertex in the middle, representing a T-spot, smooth, with rather sparse hairs, a pale green stripe in (Sapucay) the suture between ante- and post-clypeus, or the whole anteclypeus pale greenish yellow. Lips pale cadmium yellow, no darker markings. Carina at junction of superior and anterior surfaces of frons anteriorly convex in the middle, concave or straight each side.

* Kendrew, W. G., The Climates of the Continents, Oxford at the Clarendon Press, 4th edit., p. 499.

Pronotum dark brown, propleura pale brown.

Mesepisternum predominantly maroon, a greenish blue antehumeral stripe of subuniform width (1.00-1.31 mm. at mid-height where the stripe is narrower than the maroon separating it from the mid-dorsal carina and from the humeral suture; anterior half of the mid-dorsal carina pale blue or yellow, posterior half brown ochre, or brown ochre throughout. Total area of mes- and met-epimeral greenish blue stripes greater than that of the maroon which separates them, their widths as in Table 5.

Abdomen in dorsal view a little narrowed behind seg. 2, thence widening slightly and gradually to 10 (see Tables 4 and 5); terga of 4-10 with bands of minute spinules as described for *coronata*; its color indian red or roman sepia (Smith's Glossary) to black, darker posteriorly; the pale spots AD may occur on seg. 3, MD on 3-8, PD on 3-7, AL on 3-6 only, ML not distinct, PL on 3-6 or absent. Posterior ventral processes of tergum of 1, in ventral view, separated at their apices by a distance subequal to, or greater than the length of either process, this depending on the degree of contraction of the genital fossa at death, each process directed mesad and caudad; in profile view each process projects about .5 mm. beyond and at 90° with the lateral margin of the fossa and its apex is rounded, polished, not denticulated.

Auricles of seg. 2 with 3-5 teeth on the hind edge, bilaterally symmetrical in number in these three males, the lateralmost not, or much, smaller than the others. Spines of the anterior lamina .4-.65 mm. long, somewhat hairy, reaching caudad to the level of half-length of the hamular processes. Hamular processes darker than the lamina, acute anteriorly, rounded posteriorly. Hind end of sheath of penis truncated transversely, angles rounded. Glans penis: distal end truncated, bilobed, with a median terminal piece much shorter than the basal remainder of the glans and a cornu much longer than that remainder. Genital lobe projecting ca. .33-.4 mm. beyond the ventral margin of seg. 2 in front of the lobe, not denticulated.

Superior appendages longer than 8 + 9, reddish; in dorsal view each is nearly straight, lateral margin convex in basal half, almost straight in distal half, mesal margin with a row of hairs almost as long as the appendix is wide, the margin concave in the basal half, convex in the distal half, to the truncated (transversely or obliquely from within caudad and laterad) apex; a superior submedian carina for most of its length; maximum width of one appendage .98-1.23 mm. at .43-.58 of the appendage length; in profile view the lateral margin almost straight, the superior carina visible in the basal third and in the distal third to 4/10, the inferior (mesal) margin concave in the basal one-fifth to one third to an inferior subbasal tooth, thence slightly convex to the rounded apex.

Inferior appendage reaching to the level of .44-.52 of the length of the superiors, in profile view the superior margin concave throughout, inferior margin convex throughout its length; in ventral view triangular, lateral margins straight.

Wings uncolored, smoky, or slightly smoky, especially along the hind margin. Venation brown, costa paler, almost reddish. Stigma surmounting 2 + to 4 cells, burnt sienna above, brown ochre below, or brown ochre above and below. Membranule cinereous throughout.

♀. Differs from the male as follows: (two ♀♀) No trace of brown on the upper surface of the frons, labium slightly pinkish (Sapucay). Green antehumeral stripe 1.06 mm. wide at midheight (S). Posterior transverse dorsal tubercle on abd. seg. 1 .82 mm. high, = .15 of the height of the segment in its anterior part, no bands of minute spinules on terga of 4-10; no anterior transverse green stripe on 1, most of the sides of 2 inferiorly green. Pale (green) spots probably MD on 3-7, PD on 3-7 or -9, AL on 3-7 or -8 (as in ♂); the dark colors of the abdomen are mostly reddish brown (S). No ventral tergal processes of 1; anterior end of sternum of 2 with a pair of shallow pits (?). Mid-dorsal longitudinal ridge on 10 very low, no pair of anterior pits, a short black line (NT, not S) near the site of each pit of the male, fine longitudinal striolations in the posterior half of the mid-dorsum; no pits on the dorsum of 9, a black dot at the site of the pits of the male (NT, not S); anal appendages subequal in length to 10, flattened, straight, yellow, apices rounded; palps of genital valves .9 mm. long, curved, dark brown, with a terminal pencil of hairs .57 mm. long; basal genital plates bilobed, hind margin of lobes in the same transverse straight line; hind ventral angles of tergum of 9 not rounded, less than rectangular.

Dimensions.—Total length ♂ 80, ♀ 80 mm. Abdomen (excl. apps.) ♂ 49-55, ♀ 60-61, sup. apps. ♂ 6.05-7.20, ♀ 1.39-1.64, hind wing ♂ 48-51, ♀ 52-54, stigma, front wing, costal margin ♂ 3.76-4.75, ♀ 4.50-4.83 mm. Front wings with 16-20 antenodals, 12-17 postnodals, hind wings with 11-13 antenodals, 13-19 postnodals.

Discussion.—Martin⁵ page 61 recognizes a "var. *croceata*" from Brazil, with the abdomen brown without visible spots, the wings much spotted with yellow between nodus and stigma, membranule white a little gray below. I believe that the species described by Kimmins⁸ as *januaria* is in reality *coronata* Ris. Kimmins figures (2B) the head of his *januaria* with a bilobed dark spot at the anterior margin of the superior surface of the frons, whereas Hagen's original description² expressly says, "Mund und Kopf gelb, ohne Flecken, namentlich zeigt die Stirn oben keine Spur eines T-formigen Fleckes." Kimmins speaks of the type of *januaria* as being at Brussels but, unless some shifting of material has occurred, Hagen's type was in the Copenhagen Museum.

Castoraeschna longfieldae Tables 9, 13, 19; Pl. XXIV, figs. 308-310; Map 4. 1929. *Coryphaeschna longfieldae* Kimmins, Ann. Mag. Nat. Hist. (10) 3: 489, figs. 1A (genit. ♂), 1D (abd. pattern), 1F, 1G (apps. ♂), 2A (head ♂).¹

1952. *Castoraeschna longfieldae* Calv., Ent. News 63: 264.²

The following from Kimmings' description,¹ based on a single male from Burity, 2850 ft. (868 m.), Chapada, N. E. of Cuyabá, Matto Grosso, Brazil, 10.6.1927, Miss. C. E. Longfield collector, type in Brit. Mus. NH.

Face yellow, upper margin of the frons brownish (representing the top of a T-spot), frontal vesicle (vertex) transverse, black, with fine black hairs, occipital triangle yellow, about one-third as long as the length of contact of the eyes.

Thorax dark brown clothed with fine dark hairs, dorsal (antehumeral) bands green, about 1 mm. wide, interrupted above the middle by a narrow brown line; lateral bands green, the anterior (mesepimeral) band about 1.5 mm. wide, the metepimeral band triangular, about 2 mm. in width at its broadest part. Legs black.

Abdomen nearly five times as long as the thorax, slender, the third segment moderately, and the fourth and fifth very slightly, constricted; segment 1 raised dorsally to form a transverse tubercle; tergal margins of segment 1 approximated ventrally, each forming a shining black tooth with a median carina, the tooth being less obliquely truncate than in *C. januaria* Hag. In front of these projections is a transverse piliferous tubercle. Auricles with three or four teeth. Tergal margins of segment 2 nearly straight, not sinuate nor approximated as in *januaria*. Spines of the anterior lamina (fig. 1A) (our fig. 310, Pl. XXIV) slender, directed caudad and slightly divergent, at the base forming a tubercle bearing a tuft of hairs. Hamular processes large, the posterior margins truncate, apices acute, inner margins straight and narrowly separated. Outer surfaces deeply grooved. Hamular folds small, almost concealed by the hamular processes.

A median dorsal carina present on segment 3, on the apical half of segments 4 and 5, on segments 6-8, a feeble carina on segment 9, and on segment 10 a short median carina, with, on each side, a low tubercle.

Superior appendages (fig. 1 F, G) (our figs. 308, 309, Pl. XXIV) about as long as segments 9 and 10 together, slender at the base, expanding gradually to about the middle and thence tapering slightly to the rounded, somewhat truncate apex. The dorsal carina commences before the middle and gradually expands in width towards the apex. In profile, the superior appendage is slightly curved upward, the outer margin moderately sinuate. There is no inferior subbasal tooth.

Inferior appendage triangular, about one-half as long as the superiors, its breadth at the base being about one-half its length. The sides are straight and the apex rounded, bearing on the upper surface two small tubercles. Viewed laterally, it is slightly upcurved, and gradually tapering from base to apex. There are no pale markings at the base of the superior appendages.

Abdomen blackish brown, with pale markings (in life, emerald-green). On segment 1 the dorsal spot is large, the anterior margin sinuate, and the lateral spot large, rectangular. On segment 2 the anterior lateral spot large, covering the sides back to the transverse carina, and narrowly separated from the medio-dorsal spot. Postero-lateral and postero-dorsal spots confluent. On segments 3-8 the antero-lateral spot covers most of the side before the transverse carina, and is curved upwards at the apex. Medio-lateral spot on segments 3-4 small, on segments 5-8 apparently absent. Postero-lateral spot confluent with postero-dorsal. Antero-dorsal spots missing. Medio-dorsal spots on segments 3-5 quadrate, on segments 6-8 triangular. On segments 9 and 10 all spots are absent, except the confluent postero-dorsal and lateral spot, which is deeply emarginate on the ninth segment and divided on the tenth segment.

Wings hyaline, faintly tinged with brown, especially at the tips, the hind wing as long as the first nine abdominal segments. Costal margin brown, pterostigma black; membranule grey, scarcely reaching the cross-vein of the anal triangle. Venational details on our Tables 9, 13 and 19.

Dimensions.—Length of thorax 12, of abdomen 57, of segment 3 9; depth of segment 2 6, of segment 3 3; length of (superior) appendages 7, of hind wing 53; width of hind wing at nodus 16.25 mm. Front wings with 19-20 antenodals, 14-15 postnodals, hind wings with 13-14 antenodals, 15-16 postnodals.

Discussion.—*C. longfieldae* is very close to *coronata* Ris; the differences therefrom given by Kimmins¹ page 493 are very slight, especially that between the apices of the superior appendages. Compare rubrics 32 and 32a in our key, antea page 16.

Castoraeschna coronata Tables 2, 4, 5, 9, 12, 13, 19; Pl. XI, figs. 136-144; Map 4.

1918. *Coryphaeschna coronata* Ris, Archiv. Naturgesch. 82 (A) (9): 172, fig. 110 (apps. ♂).¹

1952. *Castoraeschna coronata* Calv., Ent. News 63: 264.²

1929. *Coryphaeschna januararia* Kimmins, Ann. Mag. Nat. Hist. (10) 3: 491, figs. 1B (genit. ♂), 1E (abd. pattern), 2B (head ♂).³

Material studied.—PERU: Satipo, May 16, June 10, 13-17 Nov., 1940, Pedro Paprzycki, 5 ♂ coll. C. H. Kennedy.

Distribution.—Peru as above; Bolivia: Rio Songo.¹

Altitudinal Range.—Satipo is shown on the American Geographical Society's (New York) 1942 map of South America as in the province of Junín, on a tributary of the Rio Perené, at an altitude of ca. 1000 m. (3280 ft.). Ris's type¹ came from the Rio Songo at 1000 m.

Seasonal Range.—The most comparable meteorological stations for Satipo appear to be La Merced (alt. 2460 ft.) and Huanuco (6273 ft.). The wettest and driest months for La Merced are February and July respectively, for Huanuco March and August respectively.* It would appear, therefore, that at Satipo *coronata* flies at the end of the dry season and at the end of the wet. Some further remarks on Satipo are given antea, page 155.

♂. Face yellow with a transverse black band bordering anteriorly and posteriorly the carina at the junction of the superior and anterior surfaces of the frons, the black wider on the latter than on the former and representing the head of a T-spot, but with no homologue of the stem of that spot; the carina distinctly bisinuate, each half (right and left) thereof distinctly concave anteriorly (cephalad). Labium and most of rear of eyes yellow. Line on fronto-clypeal suture yellow.

Green antehumeral stripe .8 mm. wide at upper end, 1.14-1.39 at mid-height (which is also its maximum width); green epimeral stripes as on Table 4.

Terga of abd. segs. 4-10 with a longitudinal band of closely-placed minute spinules directed caudad and arranged in oblique rows which run in an antero-dorsal to postero-ventral direction; this band extending for the whole length of each segment and situated not quite one-half-way from the denticulated lateral longitudinal carina of 4-8 and its homologue on 9 and 10 to the mid-dorsal line. Pale spots on the abd. segs. fewer and smaller than in *colorata*, ventral surface of 9 brown to black. Auricles of 2 with three teeth on the hind edge; 9 with a pair of anterior dorsal pits. Spines of the anterior lamina 1.23-1.31 mm. long, reaching caudad not as far as the level of the hind margin of the hamular processes. All five males have one of the two cornua of the glans penis broken off a little distad of its junction with the other cornu. Genital lobe without spinules.

Superior appendages in dorsal view: lateral margin convex throughout, inner margin concave almost to mid-length, thence again concave to the obliquely truncated apex whose outer angle is about 90°, the inner margin hairy, hairs shorter than the appendage width, maximum width of the appendage .82-1.06 mm. at .47-.60 of the appendage length. In profile view concave dorsad, convex ventrad, no inferior subbasal tubercle, apex obliquely truncate, inferior apical angle the more prominent, less than 90°.

Inferior appendage reaching to about half-length of the superiors, in profile view concave above, convex below, in dorsal view triangular, sides slightly concave.

Wings smoky throughout, veins dark brown, stigma indian red above and below, membranule brown gray.

* Reed, W. W., Month. Weather Review Suppl. 31, Wash., June 26, 1928, page 17.

Dimensions.—Total length 75 mm. Abdomen (excl. apps.) 50.5-55, sup. apps. 5.97-6.95, hind wing 50.5-54, pterostigma, front wing, costal edge 3.60-4.34 mm. Front wings with 20-24 antenodals, 14-17 postnodals, hind wings with 14-18 antenodals, 16-18 postnodals.

♀. Unknown.

Discussion.—On my interpretation of Kimmins' *januaria* as *coronata* see antea, page 180 under *januaria*.

- Castoraeschna castor** Tables 2, 4, 5, 9, 12, 13, 19; Pl. VI; Map 4.
 1865. *Aeschna castor* Brauer, Verhd. zool.-bot. Gesel. Wien XV: 906.¹
 1866. *Aeschna castor* Brauer, Reise d. Novara, Neur. 72, Tab. I, fig. 17 (apps. ♂).² (Date acc. to Handlirsch's bibliogr. of Brauer, Verhd. zool.-bot. Gesel. Wien 1906: 160.)
 1867. *Aeschna castor* Hagen, Verhd. zool.-bot. Gesel. Wien XVII: 50.³
 1875. *Aeschna castor* Hagen, Proc. Boston Soc. Nat. Hist. XVIII: 39.⁴
 1908. *Aeschna castor* Martin, Colls. Zool. Selys-Longchps. fasc 18: 61, fig. 57 (apps. ♂).⁵
 1918. *Coryphaeschna castor* Ris, Archiv Naturgesch. 82 A (9): 171, Taf. II, fig. 109 (wings ♂).⁶
 1929. *Coryphaeschna castor* Kimmins, Ann. Mag. Nat. Hist. (10) 3: 490, fig. 1C (abd. pattern).⁷
 1952. *Castoraeschna castor* Calv., Ent. News 63: 264.⁸
 1875. *Aeschna lunulata* Selys MS. (no description) Hagen, Proc. Boston Soc. Nat. Hist. XVIII: 40.⁹

Material Studied.—Brasilien via Dr. Puschnig (ix 31) 3 ♂, 1 ♀ coll. Dr. Erich Schmidt; Rio de Janeiro, Sep. 25, 1922, J. H. Williamson 1 ♂ ANSP; (Rio) 1 ♂ with two green labels "P Br" and "Ae. lunulata" in de Selys' hand; ³ MCZ; Südhg. Itatiaya-Gebirg. 700 m. Rio de Janeiro, x.31, Zikan collector 2 ♂, 3 ♀ coll. Schmidt; S. Paulo, S. Paulo State, Jan., 1937 1 ♀, Mar., 1937 2 ♂, 1 ♀, F. Wücherpfennig, coll. Cowley; S. Paul, via Staudinger 1928 "Aeschna castor Brauer det. Kruger (Martin)" 2 ♂ coll. Dr. E. Schmidt. Total 11 ♂, 6 ♀.

Distribution.—SURINAM ⁵ questioned by Ris.⁶ BRAZIL: States of Espirito Santo,⁶ Minas Geraes,⁶ Rio de Janeiro⁶ and São Paulo. 20°-25° South Lat., 40°-48° West Long.

Altitudinal Range.—Sea level to 700 m. (2300 ft.)

Seasonal Range.—September, October, January, March, as above. These months fall in the rainy season, the southern summer.*

* Reed, W. W., The Climates of the World, Yearbook of Agriculture 1941, U. S. Dept. Agric. Wash., page 675. Brooks, C. E. P., Climate, New York, Charles Scribner's Sons (no date but later than 1928), page 142.

♂. Face and most of rear of eyes yellow, no dark line on the fronto-clypeal suture, head of the black T-spot on the upper surface of the frons reaching far caudad so as to be longer antero-posteriorly than the stem, the head (top) $2\frac{1}{2}$ times as wide as the narrowest width of the stem, the stem bordered on each side by pale greenish which is continued laterad on to the side of the frons, carina at the junction of the superior and anterior surfaces of the frons hardly bisinuate. Labium yellow.

Green antehumeral stripe 1.23 mm. wide, narrower below, hence cuneiform, reaching from the antealar sinus to the anterior mesepisternal margin. Green mesepimeral stripe subuniformly wide, green metepimeral narrower below, between them a superior green spot below the hind wing-base continued downward as a line, the antehumeral and epimeral green stripes occupying smaller areas of their respective sclerites than in *colorata* (compare figs. 73, Pl. VI and 84, Pl. VII), the green metepimeral more irregular than in *coronata* and not at all parallel to the green mesepimeral as in that species; mid-dorsal interalar sclerites green.

Abdominal segment 1: postero-ventral tergal process in profile view measures .57-.74 mm. along its hind margin from the most ventral point of articulation between segments 1 and 2, its anterior margin .25-.41 mm. from the ventral margin of 1 to its tip, its apex is .37-.41 mm. wide, anterior margin nearly at 90° with the ventral margin of 1, hind margin forming from an acute to an obtuse angle with the ventral margin produced caudad, apex varying from subsemicircular through subsemielliptical to almost straight and truncate, showing no denticles; five males measured for these details; in ventral view no denticles visible. These teeth or processes (Fortsätze of Hagen 1867),³ our fig. 75, Pl. VI, approach each other for a distance less than the length of either tooth; in J. H. Williamson's male from Rio the distance is at least twice the length of either tooth; this distance probably depends on conditions at the time of death.

Abd. seg. 2: transverse submedian dorsal carina interrupted for about 1 mm. in its middle; terga of 4-10 with bands of minute spinules as described for *coronata*.

Coloration of abd. segs. dark brown to black, the following markings pale (green in life?): on 1 apparently a pair of anterior brown spots fused together, on 2 a stripe posterior to the transverse submedian dorsal carina meeting its fellow of the opposite side on the mid-dorsal line, MD on 3-8, PD on 1-7 or -8 or -9 (on 9 fused with AD and MD), AL on 3-4 or -7, ML on 3- or 5-10, often fused with PL, PL on 3-6 or 3-10.

Auricles of segment 2 with 4 (70%), 3 (10%), 5 (10%), 2 (5%) or 6 (5%) teeth on the hind margin; 10 males examined, 6 of them symmetrical, 4 of them asymmetrical in the number of teeth. Margins of the genital fossa reddish brown, not different in color from the adjoining inflexed part of the tergum. Anterior lamina bifid cephalad to the ventral tubercle of seg. 1, reddish brown, spines darker, straight, directed caudad and, at the extreme apex,

slightly dorsad, reaching not as far as the level of the hind end of the hamular processes. Mesal margin of the hamular process straight, subparallel to and touching that of its fellow of the opposite side, antero-mesal angle very acute, hind end rounded, lateral margin continued dorsad into the hamular fold. No spinules on the genital lobe.

Superior appendages not as long as abd. segs. 8 + 9, in dorsal view nearly straight, narrower in their proximal third, thence widening on the mesal edge to a maximum of .98-1.31 mm. at .53-.56 length, whence mesal and lateral margins are parallel almost to apex which is truncated from within outward so that the latero-posterior angle is bluntly acute or even 90°; mesal margin for the distal .7 of its length finely denticulated and with numerous hairs as long as the appendage is wide. In profile view slightly concave superiorly from base to apex; superior carina sloping ventrad from base to .3 of appendage length where it disappears below the lateral margin, to reappear above it in the distal .35-.4 of appendage length, apex rounded; an inferior subbasal rounded tubercle at .3 length, *i.e.*, just below where the superior carina disappears, this tubercle convexly rounded both proximally and distally, not preceded by a carina.

Inferior appendage reaching to the level of .42-.50 of length of the superiors, in dorsal view triangular, apex .26-.30 as wide as base; in profile view concave superiorly from base to apex.

Wings.—In the Itatiaya series of five males the wings range from clear, uncolored, to smoky throughout, the four S. Paulo males have them uncolored or, in one, faintly yellow at base to arculus. Venation brown, stigma unicolorous, both surfaces brown, membranule pale ashy brown.

♀. Differs from the male as follows: Pale spots AD on segs. 1-3, MD on 3- or 4-5, PD on 1 or 2 to -7 or -10, reduced on 7 or 8 or both, enlarged on 9, a small circular spot on 10, AL on 1-10, fused with ML on 1, 2, 9, 10, ML on 1-10 or not all of these fused with AL or PL or both, or most of dorsum of 10 pale, PL on 1-10, fused with ML as indicated.

Our fig. 76, Pl. VI, of the ventral surfaces of abd. segs. 1 and 2 of a female from the Itatiaya Mts. shows the ventral spinules of 1 mounted on a distinct tubercle .45-.5 mm. high and a pair of low ⊃C-shaped on each side of the middle line near the anterior margin of the sternum of 2; all four of the Itatiaya females and the four females from S. Paulo agree in these two features. In *Coryphaeschna luteipennis luteipennis* the ventral spinules on segment 1 are not mounted on a tubercle but occupy an almost flat triangular area wider than long. The most easily seen difference between the females of *Coryphaeschna luteipennis luteipennis* and of *Castoraeschna castor* is the narrow, linear stem of the T-spot of the frons in the former and the triangular stem in the latter, Figs. 72 and 68, Pl. VI.

Abd. seg. 9 with no dorsal pits or black marks, sternum of 10 with 30-50 spinules, hind ventral angles of tergum of 9 nearly rectangular. Palps of genital valves 1.06-1.15 mm. long, the terminal pencil of hairs .19-.33 mm. long.

Basal genital plates as for *januaria*, antea page 180. Dorsum of 10 with the mid-dorsal longitudinal ridge indistinct, but with longitudinal striolations in the mid-dorsal area, no pits, no black marks.

Anal appendages subequal in length to 10, flattened, straight, black, apex rounded or pointed.

Wings varying from uncolored except for yellow near stigma, or yellow at base to apex of triangle and more faintly at nodus and at stigma, or yellow at base to arculus or to apex of triangle and from half-way between triangle and nodus to half-way between nodus and stigma, or yellow at base to beyond triangle and between nodus and stigma, or slightly smoky throughout, to smoky throughout, irrespective of locality.

Dimensions.—Total length ♂ 77, ♀ 76 mm. Abdomen (excl. apps.) ♂ 53-57, ♀ 50-58, sup. apps. ♂ 6.46-7.12, ♀ 1.06-1.47, hind wing ♂ 50-53, ♀ 51-53, pterostigma, front wing, costal edge ♂ 3.27-4.17, ♀ 4.25-4.50 mm. Front wings with 16-20 antenodals, 11-18 postnodals, hind wings with 11-14 antenodals, 12-19 postnodals.

Discussion.—The total length of the male given by Brauer^{1 2} as 88 mm., is corrected by Hagen³ to 78 mm. for the female, which is nearly the same as ours. Brauer's single (holotype) male had three teeth on the hind margin of each auricle 2, a number which is only 10% of those found on our ten males. Such differences as appear between his description² of the colors of the abdomen and ours are probably due to post mortem changes. Ris⁶ justly comments on the contradiction between Martin's description⁵ of the appendages of the female and Hagen's;³ his specimens and ours agree with Hagen's allotype female in this respect. In the male in the MCZ the proximal side of the triangle of both hind wings measures 2.4 mm., the posterior side of the right hind wing 5.00 mm., of the left hind wing 5.29 mm.

Castoraeschna colorata Tables 2, 4, 5, 9, 12, 13, 19; Pl. VII; Map 4.
1908. *Aeschna colorata* Martin, Colls. Zool. Selys-Longchps. fasc. 18: 58 (♀ only, Ypiranga, Brazil, coll. Needham).¹
1952. *Castoraeschna colorata* Calv., Ent. News 63: 264.²

Material studied.—BRAZIL: Laguna Olho d'Agua, abril de 1949, Minas Geraes, 1 ♂ 13.645 N. Dias dos Santos in litt. 8 de Junho de 1950, in coll. dos Santos; Ypiranga [Parana?] Nov. 6, 1897, 1 ♀ holotype of Martin, in coll. Needham.

Distribution.—Brazil as above.

Altitudinal Range.—500-1000 m. (1645-3290 ft.).

Seasonal Range.—November is in the wet season, April near its end in these parts of Brazil, the southern summer. See anteà, page 184, on the seasonal range of *C. castor*.

♂. Face pale green, becoming gamboge on the dorsal surface of the frons, the latter with a dark brown (roman sepia) stem of a headless T-spot, stem widening cephalad; a dark brown transverse stripe on the middle of the transverse rugulae of the anterior surface of the frons, this stripe not as long as the width of the stem on the dorsal frontal surface; viewed from in front the area occupied by the transverse rugulae is convex above, concave below, the right and left ends rounded. Below the area of the transverse rugulae are 13-14 much shorter vertical rugulae. Rhinarium (anteclypeus), labrum and bases of mandibles almost smooth, becoming pale bluish, labrum slightly reddish at the middle of its slightly sinuate free margin, labium pale bluish.

Pronotum pale brown ochre, hind margin narrowly pale green.

Pterothorax burnt siena with apple green antehumeral (mesepisternal), mesepimeral and metepimeral stripes (widths as on Table 4), in side view of the thorax the burnt siena and green occupy almost equal areas, while in *castor* the area of the green is less, cf. figs. 84, Pl. VII, and 73, Pl. VI.

Abdomen contracted vertically and horizontally behind segment 2, thence of subuniform width and height to its apex; the postero-dorsal transverse ridge of seg. 1 in profile view inclined slightly caudad, its height .65 mm. above the dorsal surface of the anterior half of the segment (= .17 of the height of that half).

Abdomen burnt siena becoming darker posteriorly, with pale bluish(?) spots as follows: MD on 2-6, PD on 1-10, those on 6-10 being apparently united with PD + PL, AL on 2-8; no pale blue on the ventral surface, dorsum of 10 chiefly apple green, anterior fourth and hind tenth dark brown.

Auricles with 5 (right), 4 (left) posterior teeth.

Postero-ventral tergal processes of 1 in profile view slope ventrad and caudad for the whole length of the segment, form an acute angle almost at the level of the hind margin of the segment, measure .66 mm. high along their hind margin from the ventral margin of seg. 2; at .7 of their height from the ventral margin of 2 each process is .09 mm. wide, i.e., 1/7 as wide as its height, apex with four denticles on its hind margin; in ventral view each of these processes projects mesad toward its fellow of the opposite side, from which it is separated by ca. .65 mm., underlies the anterior margin of the sternum of 2 and shows a row of ca. six denticles on the hind surface of its black tip.

Anterior lamina with spines .52 mm. long, their free apical ends, .19 mm. long, visible as free only in an oblique latero-mesal view, reaching caudad to only slightly caudad of the level of the anterior end of hamular processes. Sheath of the penis anteriorly acute, bifid. Vesicle (first segment) of the penis bilobed in ventral view, terminal segment (glans) expanded on each side so as to equal the vesicle in width and terminating in two median filaments

(cornua) the dorsal much the longer, as shown in our fig. 89, Pl. VII. Genital lobe rounded, projecting ventrad, with 5-8 minute denticles on its margin. Posterior hamules each with a tuft of long hairs directed caudad.

Superior appendages in dorsal view subparallel, lateral margin a little convex throughout, mesal margin straight to an intero-ventral, minutely denticulated tubercle at .17 of the appendage length, thence concave for an equal distance, thence convex for the middle .4, thence nearly straight and parallel with the lateral margin for the terminal fourth, which is bent toward its fellow of the opposite side, apex truncated laterad and caudad, mesal angle rounded, lateral angle obtuse, mesal margin for the terminal $\frac{3}{4}$ of its length with hairs up to .6 mm. long but nowhere exceeding the width of the appendage, lateral margin with very short (.03 mm.) hairs. In profile view upper margin slightly concave, a superior carina increasing gradually in height caudad to a maximum of ca. .16 mm. slightly before the apex which is obtuse, not curved ventrad; lower margin almost straight to the intero-ventral tubercle, thence forming a bent line to one-half of the appendage length, whence it runs dorsad for the terminal half.

Inferior appendage triangular in dorsal view, sides almost straight, in profile view slightly concave above, slightly convex below, reaching to the level of half-length of the superiors where the bend of their lower margin is situated, pale brown ochre, black and bituberculate at extreme apex, basal dorsal fourth with a rounded tubercle, a little darker in color, whose anterior end is concealed between the superiors.

Wings faintly smoky, stigmata and longitudinal veins at and near the anterior margins pale brown ochre, membranule blackish, narrowly whitish along the bounding veins.

The female holotype, when received by me from Prof. J. G. Needham, was in many fragments enclosed in a cellophane envelope. The fragments consist of (1) the head, thorax and attached basal portions of the left front and hind wings and abd. segs. 1 & 2; (2-4) abdominal segments 3 or 4, 5 and 6; (5) abd. segs. 7-10; (6-7) parts of two legs; (8) one abd. app.; (9) left front wing, nodus to stigma; (10) left hind wing, apex and nodal area; (11) wing fragments; (12) right hind wing mounted on a microscope slide; one abd. segment is lost, either 3 or 4, I can not determine which.

This holotype, when described by Martin, was apparently in better condition as he gives its total length as 65 mm., abdomen 48 mm.¹ The corresponding figures in its present condition are 58 and 41 mm., due to the absence of one abdominal segment.

This holotype female differs from the male as follows: Face, vertex, occiput and labium pale clay yellow, stem of the headless T-spot of the frons brown

ochre, no dark marking on the anterior surface of the frons, rhinarium and labrum concolorous with the face. The fragments of the legs are apparently one first femur and both second legs; all are pale brown ochre including the second tarsi, spines and denticles black. Abdomen compressed, much less contracted behind seg. 2, posterior half of 2 elevated similarly to male. Pale green spots as follows: MD on 3 or 4-7, PD on 2-, 3- or 4-9, AL on 2 and 8, on other segments doubtful, dorsum of 10 pale chrome yellow. Ventral process of 1 at the hind margin of the segment in profile view 1.47 mm. wide at base, directed ventrad and cephalad, projecting .5 mm. from the ventral surface, fig. 83, Pl. VII. Tergum of 10 damaged, not clear whether there is a mid-dorsal carina or not, about 50 denticles on the sternum of 10, no dorsal pits on 9 or 10. Ovipositor and genital valves gamboge, palps of genital valves lost, lateral genital valves concealed except at base by the tergum of 9 on each side. One detached anal appendage is preserved and is concolorous with 10, straight, acute at apex on lateral (?) margin. Wings faintly yellowish along the anterior margin for the basal $\frac{3}{4}$ of their length, widening toward the base, stigma pale clay yellow, membranule almost white throughout.

Dimensions.—Total length ♂ 64, ♀ 65 mm.¹ Abdomen (excl. apps.) ♂ 42, ♀ 48,¹ sup. apps. ♂ 5.07, ♀ 1.18, hind wing ♂ 40, ♀ 45, pterostigma, front wing, costal edge ♂ 4.09, ♀ 4.34 mm. Front wings with 15-17 antenodals, 10-12 postnodals, hind wings with 10-11 antenodals, 11-14 postnodals.

Discussion.—If the preceding description of the female holotype, be compared with Martin's original description,¹ it will be noticed that he ascribes a "tête" to the T-spot of the frons. Typical T-spots in *Aeshna* have a head and top, or cross-piece which is abruptly wider than the anterior end of the stem (queue Martin); such is not the case here as may be seen from our figs. 81, 82, Pl. VII, hence our expression "headless" for both sexes of this species. Martin's "larges taches laterales" on abd. segs. 3-7 are apparently our PD. The anal loop contains 10 cells on the right hind wing, 9 on the left, but in both they fall into three vertical rows.

II. LARVAE

In this section on the larvae the only references to literature given are those to larvae. None of the exuviae and none of the alcoholic larvae which I have seen show any structures on the ventral surface of abd. segs. 1 and 2 which suggest the characteristic ventral projections of the adults of *Castoraeschna* nor any other features suggesting that genus. Hence *Castoraeschna* does not appear in the following key.

Key to the Larvae (Nymphs, Naiads) of some Neotropical Aeshninae, chiefly of the last larval instar. Modified from Wright and Petersen (1944, Ohio Jl. Sci. 44:4-151-166, 6 pls.) and Needham and Westfall, (1955, Manual N. Amer. Drgfls. 253-255).

1. Lateral lobes (palps) of the labium with the dorsal surface of the proximal segment bearing a row of setae the longest (most distal) of which are longer than the width of that segment (Fig. 580, pl. XLIV)

Gynacantha, Triacanthagyna

- 1'. Lateral lobes (palps) of the labium with the dorsal surface of the proximal segment lacking setae or with setae shorter than the width of that segment (Fig. 571, pl. XLIV), all tarsi with 3 segments 2

2. Hind angles of the head rounded (Figs. 527-530, pl. XL), lateral spines on abd. segs. 6-9 3 *Aeshna*

- 2'. Hind angles of the head angulate (Fig. 536, pl. XL, fig. 591, pl. XLV) 7 *Coryphaeschna*

3. Lateral spines on abd. seg. 6 distant from hind margin of segment by 1-2 times their own length, ♂ part of the superior appendage subequal in length to its basal width, lateral spines on 9 reaching to mid-length of 10, subequal to those on 8 4

- 3'. Lateral spines on abd. seg. 6 distant from hind margin of segment by 4 times their own length, ♂ part of the superior appendage longer than its basal width 5

4. Two pale longitudinal dorsal stripes, broad and distinct on abd. segs. 1-4 but narrowing and fading out posteriorly, puncta inconspicuous

Hesperaeschna californica

- 4'. No pale longitudinal dorsal abdominal stripes, puncta visible 6

5. No postantennal tufts of hairs on vertex and occiput

Hesperaeschna psilus

- 5'. Two postantennal tufts of hairs on vertex and two tufts on occiput

Hesperaeschna sp. no. 1 (Porto Velho, Brazil)

6. Lateral spines on abd. seg. 9 reaching to mid-length or less of 10, total length ♂ 33 mm., ♀ 34 mm. *Schizuraeschna multicolor* and *jalapensis*

- 6'. Lateral spines on 9 reaching to more than mid-length of 10, total length ♂ 31 mm., ♀ 28-32 mm. *Neureclipsa diffinis*

7. Distal end of proximal segment of labial palp squarely truncate, its outer apical angle rounded, inner apical angle acute or forming an acute tooth (Fig. 584, pl. XLIV) 8

- 7'. Distal end of proximal segment of labial palp obliquely truncate so as to form an oblique hook-like apex (Fig. 598, pl. XLV) 11

8. Inner (mesal) margin of proximal segment of labial palp straight or concave 9

- 8'. Inner (mesal) margin of proximal segment of labial palp convex throughout (Nova Teutonia) *Coryphaeschna luteipennis luteipennis*

9. Distal mental margin without teeth *Coryphaeschna rufipennis?*
9'. Distal mental margin with teeth 10
10. Distal mental margin with 2-3 rounded teeth on each side of the median
(ligular) cleft (Figs. 588, 594-596, pl. XLV) *C. adnexa*
10'. Distal mental margin with one tooth on each side of the median cleft
(Figs. 598, 602, pl. XLV) 11
11. Distal mental margin between the bases of the palps arched except for the
median cleft (Figs. 570, 571, 577, pl. XLIV) 12
11'. Distal mental margin between the palps not arched, more or less straight
except for the median cleft (Figs. 599, 602, pl. XLV) 14
12. Distal mental margin with a rounded (Figs. 584-586, pl. XLIV) or obtuse
(Fig. 600, pl. XLV) tubercle on each side of the median cleft
Coryphaeschna luteipennis 13
12'. Distal mental margin with two acute spines, one on each side of the median
cleft (Figs. 598, 602, pl. XLV) 15
13. Male part of the superior (dorsal) appendage less than half as long as the
lateral appendages (Fig. 587, pl. XLIV) *C. luteip. luteipennis*
13'. Male part of the superior (dorsal) appendage half as long as the lateral
appendages (Fig. 578, pl. XLIV) *C. luteipennis florida*
14. The two spines of the distal mental margin subparallel (Figs. 598, 599,
pl. XLV) 15
14'. The two spines of the distal mental margin diverging forward (Fig. 602,
pl. XLV) *Coryphaeschna perrensi?*
15. Size smaller, total length 47.5-52 mm. (Florida & Guatemala to Brazil)
Coryphaeschna viriditas
15'. Size larger, total length 56-65 mm. (North Carolina to Panama?)
Coryphaeschna ingens

Remarks on the preceding key.—Two methods of primarily distinguishing the larvae and exuviae of the genus *Aeshna* from those of *Coryphaeschna* exist. The first of these was that of Wright and Petersen (1944, p. 154, rubric 3): “Distal border of mentum with a pair of sharp parallel spines one on each side of the mental cleft Pl. 3 O, *Coryphaeschna*”, and “Distal border of mentum not so armed Pl. 3 P *Aeshna*”. By this method strictly applied *Aeshna* (*Hesperaeschna*) *psilus*, our figs. 545, 552, pl. XLI, *Coryphaeschna adnexa*, our figs. 588, 594-596, pl. XLV, the exuvia from Porto Velho, Brazil, our figs. 600, 601, pl. XLV, and *perrensi*? our figs. 602, pl. XLV, would fall in *Aeshna*, *ingens* and *viriditas*, our figs. 599 and 598, pl. XLV, would fall in *Coryphaeschna*. The imago of *psilus*, however, is of the genus *Aeshna* while the imagos of *adnexa*, *perrensi*, *ingens* and

viriditas are *Coryphaeschnas*. (See our key to imagos antea, pp. 9-15). The generic allocations reached by imagos and larvae therefore do not agree.

The second method of primarily distinguishing the larvae and exuviae of *Aeshna* from those of *Coryphaeschna* is that of Needham and Westfall (Manual Drgfls. N. Amer. 1955, pp. 253-255:) "Hind angles of head angulate . . . *Coryphaeschna*" and "Hind angles of head rounded or in *Aeshna eremita* sometimes slightly angulate . . . *Aeshna*". This last quotation shows that Needham and Westfall recognized that a hard and fast distinction between *Coryphaeschna* and *Aeshna* can not be based on the shape of the hind part of the head.

We meet this difficulty in endeavoring to classify our present material. Our figures on plate XLV were placed there on a modified form of Wright and Petersen's rubric, viz., Distal border of mentum with a pair of processes, one on each side of the mental cleft, which resulted in placing the ♀ exuvia from Porto Velho as a *Coryphaeschna* on this plate as figs. 600 and 601. When applying the shape of the hind part of the head as the primary character, this exuvia qualifies better as an *Aeshna* than as a *Coryphaeschna* and we must confess to the difficulty of drawing a dividing line. Still another feature presents itself: the shape of the proximal segment of the labial palp is similar in *ingens* and *viriditas* (our figs. 598 and 599, pl. XLV) both *Coryphaeschna*, and different, though similar to each other, in *psilus* (our figs. 541, 545, pl. XLI), *diffinis* (figs. 555, 559, pl. XLII), both of the genus *Aeshna*, and *adnexa* (fig. 588, pl. XLV) a *Coryphaeschna*.

In further discussion of the shape of the hind angles of the head, it may be remarked that the difference in the angulation between the *psilus* exuvia from Juan Viñas of May 4, 1910, No. 2, and that of *C. luteipennis florida* from Cartago of Feb. 23, 1910, is very slight; the hind edge of the head of the *florida* exuvia is more concave. The difference between the same *psilus* exuvia and the exuvia of *luteipennis florida* from Rio de las Cañas of Jan. 20, 1910, is distinct, the hind margin of the head of the latter being much more angulate, its dorsal (superior) appendage is 1.5 mm. long, its lateral appendages 2.17 mm., its inferiors 2.60 mm.; all five appendages reach to nearly the same transverse line but their bases are not in the same transverse line.

DESCRIPTIONS OF THE LARVAE BY SPECIES

Aeshna (Hesperaeschna) psilus Pl. XL, fig. 531, Pl. XLI, figs. 539-554; Map 2.

1955. *Aeschna psilus* Needham & Westfall, Man. Drgfls. N. Am.: 296, 297.

Material studied.—COSTA RICA: Juan Vinas, laguna, 2 ♂ exuviae, May 4, 1910; Cartago, exuviae of Aug. 22-23 (6-ult), Aug. 26-27 (5-ult), between Aug. 31 and Sept. 10, Sept. 13-17 (4-ult), Oct. 10-12 (3-ult), Nov. 10-12 (penult), 1909, Jan. 6-16, 1910 (ult) of 2 larvae collected Aug. 20, 1909, one died Sept. 26 in moulting. BRITISH GUIANA: Mt. Roraima 1932, J. G. Myers 1 ♀ larva, #3266. CUBA: Camaguey 18.iv.'30 1 ♀ larva nearly full-grown, coll. J. G. Needham. Total 1 ♀ + 1 larva, 6 ♂ exuviae.

Some developmental changes in the larval period of *psilus* are set forth below.

1. The youngest stage represented in our material is an exuvia of Aug. 22-23, 1909, of the 8ult instar of our nomenclature.* It is in fragments and has been mounted in balsam. Its fragmentary condition precludes the giving of all but a few dimensions. There are granulations on the lateral posterior angles of the head, many facets to the compound eyes. Mandibles with four subequal distal teeth (incisors) and one proximal (molar) with an anteapical tooth. Inner lobe of maxillae with five curved acute spines. Labial palps: fixed hook with setae near base of movable hook which are not as long as the width of the segment, apex squarely truncated. Distal margin of mentum with an acute tooth each side of the open median (ligular) cleft. Femora and tibiae not annulate, tarsi 2-segmented. Lateral spines on abd. segs. 7-9.

2. Next in age are two exuviae of Aug. 26-27, 1909. Total length 11.00 mm., head: maximum length 1.51-1.75, maximum width 3.67, hind dorsal margin 1.61-1.70, 4 antennal segments, mandibles with four incisors, one longer than the others, inner lobe of maxillae with six curved acute spines; mentum: length 1.80 mm., width at base .71, at mid-length .95, at distal end 1.46. Labial palps: dorsal surface of fixed hook as stated for preceding instar, movable hook .39 mm. long, with setae not as long as width of hook. Hind wing-pads reaching to mid-length or hind margin of abd. seg. 1, their front margin .5-.58 mm. Femora and tibiae faintly annulate, tarsi 2-segmented. Mid-dorsal length of abd. seg. 8 .71 mm., of 9 .61, of 10 .33, lateral spines on 6-9, their relative lengths from greatest to least 9, 8, 7, 6, those on 9 reaching to mid-length of 10. Anal apps.: mid-dorsal .5-.65 mm., its apex roundly excised, an acute spine at each lateral apical angle, lateral ("cercoids") .30 mm., inferiors ("cerci") .78-1.08.

* Anat. Record 31 (4): 327, 1925; Univ. Iowa Studies Nat. Hist. 12 (2): 14-15, 1928.

3. A 6ult exuvia shed between Aug. 31 and Sept. 10, 1909, is in fragments so that few dimensions can be taken. Head: maximum width 3.68 mm., hind dorsal margin 1.89, mandibles as stated for the preceding instar, granulations (spinules .0233 mm. long) on the lateral posterior angles of the head, facets of the compound eye numerous, hind wing-pads, front margin 1.51 mm. long, tarsi 3-segmented, inferior anal apps. 1.61 mm.

4. A 5ult exuvia shed between Sept. 13 and 17, 1909. Total length 16 mm., head: maximum length 2.62 mm., maximum width 3.44, hind dorsal margin 1.92, antennal segments 5, labium at rest reaching to hind edge of prosternum; mentum: length 2.25 mm., width at base .93, at mid-length 1.21, at distal end 1.86, distal margin with two teeth, each .01 x .032 mm. and .02 mm. from the closed ligular cleft. Labial palps: fixed hook squarely truncated at level of ligular cleft, its posterior mesal angle barely prolonged, slightly acute. Hind wing-pads reaching to a little beyond the base of abd. seg. 2, their front margin .96 mm. Tarsal segments 2-3-3. Abdomen: maximum width 4.66 mm. at seg. 6, mid-dorsal length of seg. 9 .80, of 10 .95; gonapophyses .04 mm., mid-ventral length of 9 .85; lateral spines on 6-9, their relative lengths from greatest to least 9, 8, 7, 6. Anal apps.: mid-dorsal .93 mm., its apex with notch .11 mm. deep, an acute spine at each lateral apical angle; lateral apps. .70 mm., inferiors 1.42; ratio of length of mid-dorsal to length of inferiors .65.

5. A larva which died in moulting Sept. 26, 1909, has a total length of 19 mm.; head: maximum length 3.12, maximum width 4.81, hind dorsal margin 4.73; antero-posterior rows of setae on the lateral posterior angles of head, many facets on the compound eyes, antennal segments 7. Supracoxal processes with the posterior division a little longer than the anterior. Hind wing-pads reaching to the middle of abd. seg. 2, their front margin 2.50 mm. Femora and tibiae not annulate, tarsal segments 3-3-3 and so to the end of the larval period. Abdomen: maximum width 1.82 mm., at seg. 6; mid-dorsal length of seg. 8 1.28 mm., of 9 1.09, of 10 1.04, gonapophyses .24, mid-ventral length of 9 1.04, lateral spines as stated for the preceding instar. Anal apps.: mid-dorsal 1.98 mm., its apex shallowly, roundly excised, .05 mm. deep, an acute spine at each lateral apical angle, male part .80 mm. long; lateral apps. 1.60 mm., inferiors 2.36; ratio of length of mid-dorsal to length of inferiors .84, of length of male part to length of laterals .5.

6. An antepenult or 5ult exuvia of Oct. 10-12, 1909, has lost abd. seg. 9. Head: maximum length 3.12 mm., maximum width 4.81, hind dorsal margin 2.48, spinules on the hind lateral angles; mentum: length 3.60 mm., width at base 1.18, at mid-length 1.80, at distal end 2.46, distal margin with two obtuse teeth, one on each side of ligular cleft. Front margin of hind wing-pad 1.65 mm. Anal apps.: mid-dorsal 1.23, its male part .47 mm. long, basal width .71, lateral apps. 1.08, inferiors 2.17; ratio of length of mid-dorsal to length of inferiors .56, of length of male part to the length of laterals .44.

7. A penultimate? exuvia of Nov. 10-12, 1909, has a total length of 26 mm.; head: maximum length ca. 3.40 mm., maximum width 6.79, hind dorsal margin

ca. 3.02, granulations + setae + spinules on lateral posterior angles, facets of compound eyes numerous; mentum: length 4.25 mm., width at base 1.42, at mid-length 2.41, at distal end 3.31, distal margin with a row of hairs .05 mm. long, two teeth .019 x .044 (left), .025 x .063 (right), the left .05 mm., the right .038 mm. from the closed ligular cleft. Hind wing-pads reaching to the hind margin of abd. seg. 2, their front margin 3.54 mm. Male gonapophyses .19 mm. long. Anal apps.: mid-dorsal 1.75, its male part .71, basal width .95; lateral apps. 1.42, inferiors 2.50; ratio of length of mid-dorsal to length of inferiors .70, of length of male part to length of laterals .50.

8. Ultimate exuvia shed between Jan. 6 and 16, 1910. Total length 30 mm.; head: maximum length 4.71, maximum width 8.04, hind dorsal margin 4.53, antennal segments 7. Mentum: length 6.14 mm., width at base 1.78, at mid length 3.11, at distal end 4.17, distal margin with a row of hairs 1 mm. long, no teeth visible in dorsal or ventral view (dry mount, under compound microscope), ligular cleft closed. Hind wing-pads reaching to hind margin of abd. seg. 4, their front margin 8.00 mm., tarsal segments 3. Abdomen: maximum width 5.85 mm. at seg. 7, male gonapophyses .33 mm., mid-ventral length of 9 1.64. Anal apps.: mid-dorsal 2.74, its apex transversely truncated, an acute spine at each lateral apical angle, its male part 1.18 mm. long, basal width 1.18, lateral apps. 2.60, inferiors 3.50, ratio of length of mid-dorsal to length of inferiors .78, of length of male part to length of laterals .45.

The total lengths of the successive exuviae of *psilus* are x, 11, x, 16, 19, x, 26, 30 mm. Corresponding figures of Gardner's 1950 description* of *Ae. mixta* are (1) pronymph, (2) 2.5, (3) 3.5, (4) 4.5, (5) 6.00, (6) 6.85, (7) 11.0, (8) 15.0, (9) 22.0, (10) 30 mm.

Aeshna (*Hesperaeschna*) Sp. No. 2 (Nova Teutonia, Brazil)

The following features of the ultimate larval instar are not fully mentioned in the preceding paragraph: dorsal surface of proximal segment (fixed hook) of labial palp with a proximal line of 5-7 setae, .025-.3 mm. long, and a distal cluster of 5-7 setae, .015-.52 mm. long; dorsal surface of distal segment (movable hook) 1.42-1.56 mm. long with 15-20 setae .04-.38 mm. long; posterior division of supracoxal process longer than the anterior (subequal in one Juan Viñas exuvia), antenodals in the front wing pads 16 in one exuvia, uncertain in the other two, femora and tibiae annulate, mid-dorsal length of 9 + 10 2.54-3.03 mm., lateral spine on 6, including the terminal hair, .25-.38 mm. long, on 8 .5-.98, on 9 .39-.74 mm. The ratio of the length of the mid-dorsal appendage to the length of the inferiors, in the three reared exuviae of *psilus* from Juan Viñas and Cartago, varies from .675 to .76; the ratio of the length of the male part of the mid-dorsal appendage

* Gardner, A. E., 1950, Entom. Gazette I: 128-138.

to the length of the lateral appendages from .4 to .44; male part of the superior (mid-dorsal) 1.23-1.31 mm. long, its basal width 1.23-1.31 mm.; markings of the thorax indistinct; apex of the superior appendage transversely truncated, each lateral angle an acute spine directed caudad.

The ♀ larva from Mt. Roraima probably belongs near here although it shows some slightly divergent features. It measures 23 mm. long but the terminal abdominal segments are somewhat retracted so that the total length in life was probably a few millimeters greater. Maximum width of head 4.25 mm., antennae 8-segmented, third segment longest, front margin of the hind wing pad .85 mm. long, genitalia .71 mm., mid-ventral length of abd. seg. 9 1.13, mid-dorsal appendage 2.36, its apex very acute, lateral appendages .71, inferiors 2.17 mm. These divergent features may indicate that this Mt. Roraima larva belongs to *Ae. (H.) cornigera planaltica* to which I referred an imago from the same locality antea, page 49. For some further data on this larva see the following paragraph.

By our key to larvae there falls also in *psilus* a ♀ exuvia from Porto Velho, Brazil, May 5, 1922, "on under side green leaf 3" above little creek in woods 2½ miles SE" by J. H. Williamson, UM. Total length 32 mm., median length of head 5.48, maximum width of head 8.34, its hind angles distinctly rounded, basal width of mentum 2.45, distal width 5.40 hind wing pads reaching to a little beyond mid-length of abd. seg. 4, their front edge 8.57, maximum width of abdomen 6.63 at segment 6, genitalia 3.11, mid-ventral length of 9 2.29, mid-dorsal (superior) appendage 2.54, its apex squarely truncate, lateral apps. 3.03, inferiors 3.27, femora and tibiae annulate, lateral spines on abd. segs. 5-9, those on 6 distant from the hind margin of the segment by their own length, lateral spines on 9 reaching to mid-length of 10, subequal to those on 8, ratio of the length of the mid-dorsal app. to that of the inferiors .775. Striking features are a tuft of brown hairs, 1.15 mm. long, on each side of the vertex behind the level of the basae of the antennae, and a similar tuft of brown hairs, 1.47 mm. long, on each side of the occiput a little farther apart than the preceding tufts. No traces of these tufts are visible in the *psilus* exuviae or larvae or in the Mt. Roraima larva. Instead of the posterior pair of hair tufts the Mt. Roraima larva has nine or ten antero-posterior rows of minute granulations on each half of the occiput; these rows of granulations are lacking in *psilus* exuviae and larvae from Costa Rica but present in the female larva from Camaguey, Cuba.

The surface of the body of the Porto Velho exuvia is incrustated with debris; it is hence uncertain whether there are any pale dorsal abdominal stripes; lateral, latero-dorsal and dorsal puncta are visible on abd. segs. 3-8. The distal mental margin of this Porto Velho exuvia is figured on Pl. XLV, figs. 600, 601, as a *Coryphaeschna*, following

the method of Wright and Petersen. The labial palps in fig. 600 are certainly more like those of *ingens*, fig. 598, Pl. XLV, and of *viriditas*, fig. 599, Pl. XLV, than those of *psilus*, figs. 545, 541, Pl. XLI, or of *adnexa*, fig. 588, Pl. XLV. The hind angles of the head are rounded in the Porto Velho exuvia, and in the *psilus* exuviae from Juan Viñas and Cartago, but angulate in the *ingens* exuvia from North Carolina and larva from Florida, the *adnexa* larvae from Porto Rico and the *viriditas* from Fortaleza.

Aeshna (Hesperaeschna) sp. No. 1 (Porto Velho, Brazil) Pl. XLV, figs. 600, 601; Map 1.

Material studied.—BRAZIL: Porto Velho, on under side green leaf 3' above little creek in woods 26 miles S. E., May 5, 1922, J. H. Williamson, 1 ♀ exuvia coll. E. B. Williamson UM.

Total length 37 mm., maximum length of head 5.40, maximum width of head 8.18, hind dorsal margin ca. 5.00, concave to a depth of .33 mm. in the mid-dorsal line; hairs and granulations at each lateral posterior angle, arranged in 13-15 parallel longitudinal rows, alternate rows a little longer, front dorsal margin almost straight, very slightly concave. Antennal segments 7, 3rd segment longest, a little shorter than 1 + 2; ocelli faintly indicated, compound eyes with many facets, a small bunch of brown hairs at each side of the ocellar tubercle (vertex), a larger bunch of brown hairs on the occiput behind the mesal projection of each compound eye, this mesal projection being punctulose, not faceted, the larger bunches farther apart than those on the vertex; labrum and nasus (postclypeus) subequally wide, rhinarium narrower, mandibles projecting laterad farther than labrum or clypeus, in ventral view angulate. Base of mentum damaged, width at mid-length 4.17 mm., at distal end 5.32, distal margin with a median, almost semi-circular cleft, .40 mm. at the margin, .2 mm. deep, the cleft with a minute dark brown tooth at each side (Figs. 600, 601, pl. XLV). Fixed hook of labial palp obliquely truncated at apex to form an acute angle, mesal margin concave, denticulated (about 15 denticles) (Fig. 600, pl. XLV); movable hook 2.62 mm. long, tapering throughout its length.

Pronotum and left propleura damaged, right propleura with posterior division of supracoxal process twice as long (high) and twice as wide as the anterior division and pointed caudad, right half of pronotum with a rectangular lateral process. Hind wing-pad reaching to mid-length of abdominal segment 5, its front margin 9.43 mm. long. Third femora 5.85 mm. long, all femora with three transverse dark bands, all tibiae with three dark bands, all tarsi with first segment darker, second and third segments each with a dark band.

Abdomen: maximum width 6.51 mm. at segment 6; the surface of the body is encrusted with debris; it is hence uncertain whether there are any pale dorsal abdominal stripes; dorsal, latero-dorsal and lateral puncta are visible on

segments 3-8. Genitalia 3.11 mm. long, mid-ventral length of abd. seg. 9 2.29. Lateral spines on segments 5-9, shortest (.19 mm.) on 5, those on 6 half as long as the intersegmental area 6-7, those on 9 reaching to mid-length of 10 and subequal to those on 8. Anal appendages: mid-dorsal 2.45 mm. long, longer than segment 10, shorter than 9 + 10, apex transversely truncated. Lateral (left, right broken) 3.03 mm., inferiors 3.27, ratio of the length of the mid-dorsal to that of the inferiors .775.

Discussion.—No traces of the tufts of hairs on vertex and occiput are visible in the *psilus* larvae or exuviae from Costa Rica, Mt. Roraima or Camaguey. The antero-posterior rows of spinules and/or granulations on the posterior lateral angles of the head are present in the Porto Velho exuvia, the *psilus* larvae and exuviae from Costa Rica, Mt. Roraima and Camaguey. The labial palps of the Porto Velho exuvia are more like those of *Coryphaeschna ingens* (fig. 598, Pl. XLV) and of *C. viriditas* (fig. 599, Pl. XLV) than those of *Ae. (H.) psilus* (figs. 545, 541, Pl. XLI) or of *C. adnexa* (fig. 588, Pl. XLV). The hind angles of the head are rounded in the Porto Velho exuvia, the *psilus* exuviae from Juan Viñas and Cartago (fig. 531, Pl. XL), but angulate in the *C. ingens* exuvia from North Carolina and larva from Florida (fig. 536, Pl. XL), the *adnexa* larvae from Porto Rico and the *C. viriditas* larva from Fortaleza (fig. 535, Pl. XL). Compare the Remarks on the key to larvae, antea pages 192-193.

Aeshna (Hesperaeschna) variegata (Fabricius) Map 1.

1904. *Aeshna diffinis* Forma c Ris, Hamburg. Magal. Sammelreise, Odonaten: 27, fig. 14a (ventral) b (dorsal view, entire larva).

No larvae or exuviae of this species are available. Dr. Ris did not describe his larva, and his figures alone are not sufficient to enable it to be placed in our key.

Aeshna (Schizuraeschna) jalapensis (Williamson) Map 4.

Material studied.—GUATEMALA: Los Amates, Dept. Izabal, in bog, Jan. 1, 1904, ♂ exuvia; Agua Caliente, Dept. Santa Rosa, June 1, 1909, ♂ exuvia; Amatitlan ♀ larva; all three by E. B. Williamson, UM. COSTA RICA: Cartago, from surface of dried up pool, shady lane, Feb. 23, 1910, P. P. Calvert, 1 ♂ exuvia, coll. P.P.C. VENEZUELA: Upata, State of Bolivar, March, 1942, 1 ♀ larva, 3 small larvae, sex indeterminate, in alcohol, by Paul Anduze, coll. J. G. Needham. CUBA: Arroyo Rancho Capitan in Finca Mamea, Trinidad Mts., 4 larvae in alcohol, 2 larger ♀, 1 smaller ♂, 1 smaller ♀, all 23.III.'39, J. G. Needham. Total 1 ♂, 5 ♀, 3 sex ? larvae, 3 ♂ exuviae. (Trinidad is situated

at 80° West Longitude; the name of its province is given as Las Villas, or as Santa Clara, on different maps. No imagoes of *jalapensis* are known from Cuba.)

Total length Guatemala ♂ 40, ♀ 38, Costa Rica, Cartago ♂ 39, Venezuela 37-4.58, Cuba ♂ 22, ♀ 30-?18.5; median length of head G ♂ 5.56, ♀ 5.73-6.21, Cuba ♀ 4.75-4.00 (the larger 2); maximum width of head G ♀ 7.83, ♂ 7.77-8.42, V 7.85-1.31, C ♀ 7.61-7.77 (the two larger ♀); hind dorsal margin of head G ♀ 5.40, ♂ 4.56-4.66 mm.; antennal segments G ♂ 7, ♀ 8; mentum, length G ♂ 6.87, ♀ 7.53 mm., basal width G ♂ 3.11, ♀ 2.86, V 2.05, width at mid-length G ♀ 3.76, ♂ 3.19-3.85, distal width G ♀ 4.83, ♂ 4.75-5.10 V 4.66 (large ♀ only), hind wing-pads reach to hind margin of abd. seg. 3 G ♂, to middle of 4 V (large ♀ only), to slightly caudad of beginning of 5 to not quite the beginning of 2 C ♀ ♀, (in the last case the venation is beginning to appear), length of front margin of hind wing-pads G ♀ 8.68, ♂ 8.02-8.83, V 7.77 mm. (large ♀ only, absent from the three small), maximum width of abdomen G ♀ 7.36, ♂ 7.28-7.36, V 6.78 (large ♀ only), C 6.78-6.87 (the two larger ♀), in all cases at seg. 6, length of ♂ gonapophyses G .25, length of ovipositor G 1.55-2.21, of genital valves G 1.64-2.45, V 1.8, dorsal (superior) anal appendage length G ♀ 3.11, ♂ 3.44-3.60, V 3.03 (large ♀), its apex transversely truncated, a minute spine at each lateral angle, lateral appendages G ♀ 3.44, ♂ 3.68-3.85, V 3.52, inferiors G ♀ 3.76, ♂ 3.76-3.93, V 4.00, fixed hook (proximal segment) of labial palp truncated at apex, its inner (mesal) angle forming a sharp tooth about half as long (.16 mm. V) as the width of the segment (G and V), shorter (.04 mm. and less) C, in the G this angle almost rectangular (right) or obtuse (left), therefore no sharp tooth; the two divisions of the supracoxal process of the propleura subequal in size (G, CR, V), femora and tibiae more distinctly annulate in the Venezuelan than in those from Guatemala, Costa Rica and Cuba; the smallest two larvae from Cuba have the lateral spines on abd. seg. 9 reaching to a little beyond mid-length of 10 and to the hind margin of 10 respectively, the largest two, G ♂, V ♀ to mid-length of 10, the Cartago ♂ exuvia to less than mid-length of 10; ratio of length of dorsal app. to length of inferior apps. G ♂ .83, ♀ .915, V ♀ .76; ♂ part of dorsal app. G 1.64 mm., Cartago 1.61 mm., ratio of its length to that of the lateral apps. G. .48, Cartago .485.

The abdomen of the Amatitlan ♀ and of the Agua Caliente ♂ has a mid-dorsal dark brown stripe, 1.23-1.5 mm. wide, on 1 to mid-length of 8, bordered by pale on each side; this pale is absent from the V ♀ although lateral puncta are visible but not prominent. The four Cuban examples show the coloration better than those from Guatemala, Costa Rica, or Venezuela; they are pale cadmium yellow with bilaterally symmetrical pale brown spots on the dorsum of head between and also behind the eyes, pale brown sprinkled over thorax and abdomen; darker brown are: a short line mesad of each antenna (in the larger two ♀ only, a small spot at each ocellar site, a transverse spot behind the mesal prolongation of each compound eye, a lateral marginal stripe behind each eye and continued on to the thorax, a pair of stripes on the anterior half of each of

abd. segs. 4-8 or -9, separated from each other by a narrower, mid-dorsal, longitudinal, pale gamboge stripe, two pairs of dorsal puncta on each of 3-10, the anterior pair larger than the posterior, dorso-lateral puncta on 3-8, lateral puncta on 3-8, lateral scars on 3-8, a terminal and an anteterminal band on the lateral appendages; the ventral abdominal surface without definite markings but sprinkled with brown. The exuvia from Agua Caliente has the pale cadmium yellow between the paramedian brown and the dorso-lateral puncta more sharply defined than in the Cuban larvae.

All the Venezuelan and Cuban examples are less than full-grown.

Aeshna (Neureclipsa) diffinis (Rambur) Pl. XL, figs. 527-530; Pl. XLII, figs. 555-561; Map 6.

Material studied.—CHILE: Villa Alemana, Prov. de Valparaiso, 1922, R. Martin 1 ♂, 3 ♀ exuviae coll. P.P.C.; Angol, Jan., Feb., 1940, and near the Malleco River 1940 or 1941, many larvae of various sizes and both sexes, all by D. S. Bullock, coll. J. G. Needham. Total \times ♂ ♀ larvae, 1 ♂ 3 ♀ exuviae.

Data taken from this material are presented in the accompanying table.

The mentum has granulations on and near the lateral margins of the proximal half (Figs. 555, 558, ab, Pl. XLII).

The dimensions of the largest larva, a female, from Angol and the Malleco River do not differ significantly from those of the ultimate exuviae from Villa Alemana, so that this and other alcoholic larvae of nearly the same size are, doubtless, of the ultimate larval instar. This larva corresponds to Dr. Walker's (1912, page 48) "Stage H (full grown)" of North American *Aeshnas*, or ult of our nomenclature.* As compared with Mr. Gardner's (1950†) description and figures of the "10th and final instar" of English examples of *Aeshna mixta*, those from Villa Alemana, Angol and the Malleco River are a little smaller, have 8 vs. 7 antennal segments and the tibiae faintly annulate; our fig. 557, Pl. XLII, is similar in many respects to his figure a on page 136 of a sixth instar *mixta*. The smallest of our larvae correspond to Stage D of Dr. Walker or 5ult of our nomenclature; it combines features of the 7th and 8th instars of Mr. Gardner. A comparison of the last two vertical columns of the table will show some of the changes in size in the course of larval development.

The venation of a hind wing-pad of an Angol male is shown in our fig. 561, Pl. XLII; the following differences were found in a Malleco River male: the anterior side of the discoidal triangle (t) complete, a faint trace of a cross-vein in the discoidal triangle, cells between the fork of Rs less distinct although apparently three rows.

The male part of the mid-dorsal appendage of the Villa Alemana exuvia is 1.39 mm. long.

* Calvert, P. P., 1925, *Anat. Record*, 31(4): 327; 1928, *Univ. Iowa Studies Nat. Hist.* 12(2): 14-15.

† Gardner, A. E., 1950, *Entom. Gazette* 1: 132-138.

	Ultimate Exuviae		Alcoholic Larvae	
	Villa Alemana		Angol and the Malleco River	
			Largest	Smallest
Total length	♂30 mm.	♀28.5-31	32 mm.	9.08 mm.
Median length of head	4.91	4.91-5.24	4.09	1.32
Maximum width of head	6.71	6.87-7.36	7.23	2.70
Antennal segments	8	8	8	7
Mentum, basal width	2.37 mm.	2.13-2.21	2.45	.9
width at, mid-l.	3.11	3.03-3.11	3.35	.9
distal width	4.09	4.00-4.09	4.17	1.27
Hind wing-pads reach to	?	mid-seg.	2/3 of 4	mid-length
		abd. 4 or 5		of 1
length of front marg.	6.29	5.56-8.10	6.63 mm.	.57 mm.
Tarsal segments	?-3-3	2 or 3-3-3	3-3-3	3-3-3
Maximum width abdomen	6.3 mm.	6.87-7.12	6.63 at 6	2.84 at seg. 7
Genitalia	.2 mm.	1.47-1.64	1.72	not visible
Mid-ventral length of 9	1.72	1.64-1.88	2.05	.47 mm.
Dorsal abdom. app. leng.	2.62	2.54-2.95	2.21	.76 mm.
its apex		deeply, roundly excised		
Lateral appendages	1.96	1.64-1.96	1.55	.24 mm.
Inferior appendages	3.44	2.29-3.35	3.85	1.28 mm.
Movable hook, lab. palp	1.23	1.55-1.64	1.55	.47 mm.
Front wing-pads, anten.	22	?	13-	not visible
Femora	ann.	not annulate	faintly annulate	
		ate		
Tibiae	ann.	not annul.	faintly annulate	
Lateral spine ab. seg. 6	.08	.06-.33	0	.09 mm.
ab. seg. 7	.41	.33-.61	.41	.19 mm.
ab. seg. 8	.5	.37-.74	.57	.33 mm.
ab. seg. 9	.5	.57-.82	.33	.28 mm.
Ratio $\frac{\text{length dors. app.}}{\text{length inf. apps.}}$.76	93 (aver.)	.57	.60

The color of the thorax of the exuviae from Villa Alemana is dull and unicolorous, of the male clay yellow, of the females gray; of the largest female larva between pale cadmium yellow and pale clay yellow, of the smallest larva pale brown variegated with still paler brown. On the abdomen of both the exuviae and the larvae dorsal, dorso-lateral and lateral puncta and lateral scars can be distinguished, but dorsal stripes are not defined.

Coryphaeschna adnexa (Hagen) Pl. XLV, figs. 588, 594-597; Map 7.
1938. *C. adnexa* Garcia-Diaz, Journ. Agric. Univ. Puerto Rico 22 (1): 75,
pl. V, fig. 4 (labium), Pl. VI, fig. 7 (caudal apps.)¹

Material studied.—PORTO RICO: "L(aguna) Tortugueiro, P. R. 20.III.05 Not reared but almost certain" in Prof. J. G. Needham's handwriting, 2 ♂, 2 ♀ larvae coll. Needham.

Total length ♂ 25-31 mm., ♀ 27, median length of head ♂ 6.14, ♀ 3.44-4.75. Antennae 7-segmented. Mentum similar in shape to those for penult and ult of *C. luteipennis florida* (figs. 571, 572, 577, Pl. XLIV), 6.78 mm. long, maximum width 4.75, distal margin as in figs. 588, 594-596, Pl. XLV, except that teeth and crenulations on each side of the median cleft differ in detail although not more than figs. 594-596 differ from each other. Median cleft of distal mental margin .20 mm. deep, .20 mm. wide at mouth. Labial palps: apex of fixed hook .41 mm. wide, therefore wider than in fig. 588, setae present in a single row on the movable hook and as a small cluster of 4-5 on the fixed hook near the articulation of the movable hook; all these setae much shorter than half the width of the movable hook.

Front margin of hind wing-pad 7.94-3.27 mm. Venation in some areas distinct, fork of Rs under stigma with two rows of cells, three vertical rows of cells in the anal loop, two horizontal rows of cells in the supplemental anal loop, but its distal end not sharply defined, triangle outlined but its cross-veins indistinct, no supratrangulars visible, one row of cells each between M1 and M2 and between M2 and Rs out to the fork of Rs, arculus indistinct; all these venational details which are distinct compared with the venation of an imago from Guayaquil.

Abdomen: maximum width 6.95 mm. at segment 6, lateral spines on segments 6 (.41 mm.)-9(.57 mm.). Mid-dorsal appendage 3.44 mm. long, 1.39 wide at base, apex .41 wide, truncated, lateral angles slightly rounded off, male part 1.27 long, 1.39 wide at base, tapering to the apex. Laterals (cercoids) subequally long to the mid-dorsal, inferiors (cerci) very slightly longer (.08 mm.), each with a longitudinal, dorsal, dark brown streak on the sixth seventh of their length. Colors mostly faded.

Geijskes thinks * that Garcia-Diaz' description¹ of *C. adnexa* is really that of *Gynacantha nervosa*. Prof. Needham, however, believes

* Geijskes, D. C., 1943, Ent. News, LIV(3): 71.

that Garcia-Diaz' identification is correct; certainly Garcia-Diaz' description and figures do not agree with the characters given for *Gynacantha* in our key (antea page 191).

Coryphaeschna luteipennis luteipennis (Burmeister) Pl. XL, figs. 533, 538, Pl. XLIV, fig. 587, Map 7.

1881. *Aeschna* sp. Cabot, Mem. Mus. Comp. Zool. VIII (1): 25, No. 19, pl. I, figs. 4 (entire larva), 4d (distal margin, one labial palp).¹

1934. *Aeschna* (*Coryphaeschna*) *luteipennis* Calvert, Proc. Amer. Philos. Soc. 73 (1): 45 (lat. abd. spines).²

1948. *Aeschna* (*Coryphaeschna*) near *luteipennis*? Calvert, Bol. Mus. Nac. Rio de Janeiro, nova serie, Zool. N. 87: 12, figs. 1-3 (distal mental margin, app., caudal half of abd.).³

Material studied.—BRAZIL: Porto Velho, 1-27-22, J. H. Williamson 1 ♂ exuvia No. 16; Agua Limpa near Juiz de Fora, Minas Geraes, Mar. 27, 1925, rapid mountain stream, F. M. Root 1 ♀ larva coll. P. P. C.; Passo dos Indios, 27° 7' S., 52° 36' W., 14-16 Dez., 1936, 12 larvae, at least one of these a male and one a female, and Nova Teutonia, 1935, 2 ♀ larvae, 9.I.36 by plants 1 ♂ exuvia, all by Fritz Plaumann, coll. P. P. C.; Nova Teutonia, same collector 1 ♀ exuvia coll. E. Schmidt. Total 15 (1♂ 4 ♀) larvae, 2 ♂, 1 ♀ exuviae.

In the following description the first figure after each item is that of the Porto Velho male, the second and third those of a male and a female from Santa Catharina, followed by the range of size of the remaining specimens from the latter State.

Total length ♂ ca. 34 mm., ♂ 35, ♀ 42, 25-5.97; head, maximum length x, ♂ 5., ♀ 7.20, 2.70-1.13; maximum width ♂ 6.71, ♂ 7.53, ♀ 9., 5.-1.70; hind dorsal margin shallowly concave to a depth of .33-.24 mm. on the median dorsal line, granulations on lateral posterior angles of head in antero-posterior rows, spinules + hairs on lateral margins of head behind eyes, many facets on compound eyes, antennal segments ♂ 7, ♂ 6R, ♀ 7L, 7-4; segment 3 almost as long as 1 + 2, longer than any one of 4-7; mandibles projecting laterad beyond the levels of the frons, clypeus or labrum. Labium folded back at rest reaches caudad to the second coxae or to the base of the third coxae, mentum length x, 5.55, 7.20, 6.38-1.09 mm., its lateral margins diverging throughout from base, more strongly in the distal half, basal width 2.45, 2.13, 2.64, 1.46-.41, width at mid-length x, 2.95, 3.44, 2.84-.56, distal width 4.34, 4.17, 5.19, 4.25-.65; distal margin without teeth (Porto Velho), with two blunt teeth, right .025 mm. long x .063 mm. wide at base and .23 mm. distant from the closed median (ligular) cleft, left .019 x .05 and .22 from cleft, the margin between the teeth not produced cephalad but truncated almost transversely and not angulated at each tooth (Passo d. Indios); with two triangular teeth, each .013 mm. long and at

1/6 of the distance from the closed ligular cleft to the base of the labial palp; teeth .032-.005 mm. long, at .16-.10 mm. of the distance stated; a second male has the median part of the distal margin more produced cephalad so as to form a mid-ventral angle of slightly more than 90° and the ligular cleft open; proximal segment (fixed hook) of the labial palp, Porto Velho, of a shape between figs. 588 and 602, Pl. XLV (not as in any of Needham & Westfall's 1955 figures A-E, p. 295); Santa Catharina females: squarely truncated at apex near the level of the ligular cleft, an acute tooth at the inner (posterior) apical angle varying in its degree of prolongation; inner (mesal or posterior) margin almost straight, denticulated (16-20 denticles), distal segment of the palp (movable hook) reaching to a level of more than half-way to the mesal end of the base of the palp of the opposite side, tapering from base to apex; pronotum in the Santa Catharina material maximum width 5.28-.76 mm., divided by two transverse carinae into three areas whose respective mid-dorsal lengths are .47, 1.41 and .28 mm., anterior carina straight, posterior carina concave anteriorly, running laterad on to a lateral process having a rounded apex at the maximal pronotal width, no oblique carina as in *C. viriditas*. Supracoxal process in the Santa Catharina material bifid, in the largest females the anterior division .28 x .37 mm., the posterior .37 x .47, the interval between them ca. 30 on the propleura; in the smaller males and females both divisions are smaller and the interval less marked or absent; supracoxal processes are present but smaller on meso- and metapleura. Front wing-pads reaching to the hind edge of the meta-thorax or to that of abd. seg. 1. Hind wing-pads reaching to a little less than the hind margin of abdominal segment 2 to a little beyond the front margin of 4, absent in individuals shorter than 9.5 mm. total length, length of front margin 8.1, 4.02, 9.43, 5.24-.28 mm., contained venation visible in the larger examples. In the largest male from Passo dos Indios all the coxae have an acute dorsal spine opposite the interval between the two divisions of their supracoxal processes, hardly visible in the second male, not found in the remaining examples. Hind legs reaching to the hind margin of the 5th, 6th or 7th abd. segment with increasing age. Tarsal segments three in all this material except in the smallest three from Passo dos Dios which have two.

Abdomen: maximum width 7.04 mm., 6.54, 8.30, 3.40-1.37, usually at segment 6; with numerous setae .05 to .16 mm. long, arranged in many irregular longitudinal rows; gonapophyses *x*, .16 mm., projecting .09 mm. behind the hind margin of abd. seg. 9 to barely visible; lateral spines on segments 5- or 6-9 in all, shortest on 5: .33, .24, .57, .14-.025 and distant from the hind margin of its segment by its own length; in the Porto Velho exuvia the lateral spines on 8 are .41 mm., on 9 .5 and reach almost to the mid-length of 10. Anal apps.: mid-dorsal 3.35, 2.74, 3.68, 1.39-.33, shorter than segs. 9 + 10 in the younger examples, longer than 9 + 10 in the older, its apex transversely truncated, lateral apical angles rounded (PV), squarely truncated (PdD ♂), deeply excised to a depth of .07 mm., width .09-.57 (Santa Catharina ♀), excision .49-.032 mm. deep, width .12-.06 mm., the male part 1.15 mm. long, basal width 1.31 (PV), 1.18 (PdD),

not visible in individuals 12.5 mm. long and smaller; lateral apps. 3.60, 3.27, 4.29, 3.86-.31; inferiors 3.52, 3.27, 4.74, 4.05, .61, subequal to abd. segs. 9 + 10 and shorter than 8 + 9 in younger and longer than 9 + 10, subequal to 8 + 9 in older individuals.

The variations in the abdominal colors are shown in the following descriptions:

Nova Teutonia 42 mm. long. Gamboge, minute brownish flecks forming a more or less defined mid-dorsal, longitudinal band on segments 4 (.84 mm. wide)—9 (1.13 mm. wide), this band bisected longitudinally at the articulations of 3-5 by a faint yellow line. Hindmost fourth of each segment pale yellow with longitudinal brownish bands on some. Two pairs of short (.38 mm.), transverse, linear, reddish dorsal puncta on 4-8. A dorso-lateral punctum on 1-9 (a mere dot on 1, 4-9, elongated longitudinally on 2-4). A lateral punctum on 2-8, of varying size and distinctness. Lateral scars not prominent.

Nova Teutonia 40 mm. long. Dull gamboge, a pair of brown ochre spots on the anterior half of 3-9 forming a maculose mid-dorsal band 1.64 mm. wide on segment 4, 1.06 mm. on 9. Hindmost fourth of each segment pale clay yellow. Two pairs of transverse, linear, brown dorsal puncta, the second pair contracted to dots on 4-8. Dorso-lateral puncta faint brown dots on 4-8. Lateral puncta brown dots on 2-9. Lateral scars not prominent.

Agua Limpia 36 mm. long. Gamboge, a mid-dorsal, longitudinal, burnt sienna band on 1-10, 1.64 mm. wide on 3, 1.15 mm. on 10, divided briefly on 1-9 by a mid-dorsal yellow band. Hindmost fourth to fifth of each segment pale green. Dorsal puncta not evident. Dorso-lateral puncta faint on 6-8, surrounded by diffuse pale brown clouds on 3(?) -10. Lateral scars not prominent.

Coryphaeschna luteipennis florida (Hagen) Pl. XL, figs. 526, 532, 537, Pl. XLII, figs. 562-566, Pl. XLIII, figs. 567-568, Pl. XLIV, figs. 569-579, 581-586; Map 7.

1948. *Aeschna* (*Coryphaeschna*) *luteipennis* Calvert, Bol. Mus. Nac. Rio Janeiro, nova serie, Zool. N. 87: 14.¹

Material studied.—GUATEMALA: Amatitlan, not dated, probably 1905, 1 ♀ larva, Los Amates, in bog, 1-21-1905, 1 ♂ larva, 1 ♀ exuvia, all by E. B. Williamson, UM. COSTA RICA: Cartago, two individuals partly reared by the writer one of which furnished the following exuviae from eggs laid Oct. 8, 1909: 1st instar Oct. 26 5, 2nd instar Oct. 26 5, Nov. 9 1, 3rd instar Dec. 31 1 (lost), 4th instar between Jan. 7 and 16, 1910, 1, 5th instar between Jan. 19 and 29 1, 6th instar Feb. 11-12 1, 7th instar Feb. 25-27 1, 8th instar Mar. 21-23 lost,* April 15 lost; * from the other individual, collected Sept. 20, at S. Isidro de Cartago, came the following exuviae: 6ult (probably 8th) instar Sept. 27 1 ♀, 5ult (probably 9th) instar between Oct. 15 and 24 1 ♀, 4ult (probably

10th) instar Nov. 10-12 1 ♀, 3ult (probably 11th) instar Dec. 12 1 ♀, penult (probably 12th) instar between Jan. 7 and 16, 1910, 1 ♀, also not reared 2 ♀ larvae, nos. 16 and 17 1909, all the Cartago material by P. P. Calvert; Las Concavas laguna near Cartago July 17, 1925 1 ♀ larva by C. H. Lankester; Rio de las Canas, N. of Santa Cruz, Guanacaste, Jan. 30, 1910, Tristan & Calvert 1 ♂, 1 ♀ exuviae coll. P. P. C. VENEZUELA: Open savannah swamp 2½ miles W. of Bejuma on round rush still green 2-18-1920 1 ♂ exuvia; lagoon Tucacas 3-20-'20 1 ♂ 1 ♀ exuviae, all three by E. B. Williamson UM; Parai-depuy, June '41, Anduze, 1 ♂ and 1 larva indeterminate for sex, coll. Needham. Total 2 ♂ 4 ♀ 1 x larvae, 3 ♂ 8 ♀ 15 x exuviae.

Some developmental changes in the larval period of *luteipennis florida* are set forth below.

1st instar. Total length 2.08-2.17 mm., maximum width of head .80-1.06, antennal segments 3, no hind wing-pads, tarsal segments 1, no gonapophyses, lateral spines on abd. segs. 6-9, lateral apps. apparently not visible, inferiors .30-.35, mentum of one individual seems to have two teeth on the distal margin.

2nd instar. Total length 2.55-3.85 mm., maximum width of head .85-1.04, antennal segments 3, distal mental margin with two larger and ten or more smaller teeth in at least one individual (fig. 582, Pl. XLIV), no hind wing-pads, tarsal segments 1 or 2, no gonapophyses, lateral spines on abd. segs. 6-9, lateral apps. .04 mm. long, inferiors .35-.4 long.

3rd instar. Material lost.

4th instar. Total length ca. 5.48 mm., maximum width of head ca. 1.72, no hind wing-pads, tarsi lost, no gonapophyses, lateral spines on abd. segs. 6-9 and so to end of larval period, lateral apps. .35 mm. long, inferiors .54.

5th instar. Only abd. segs. 1-8 preserved, remainder lost.

6th instar. Total length 7.61 mm., maximum width of head 2.13, antennal segments 4, no hind wing-pads, tarsal segments 2, no gonapophyses, lateral apps. .45 mm. long, inferiors .72.

7th instar. Total length 10.23 mm., maximum width of head 2.78, antennal segs. 5, front margin of front wing-pads .15 mm., of hind wing-pads .16, tarsal segments 3-2-2, width of abd. seg. 7 1.70 mm., gonapophyses of 8 two transversely elongated, elliptical rudiments ca. .04 mm. in diameter, ca. .05 distant from each other and slightly less distant from the hind margin of 8; of 9 roughly elliptical, slanting caudad and laterad, ca. .04 mm. long, ca. .025 mm. from each other, ca. .11 mm. from anterior ventral margin of 9, lateral spines in order of length from greatest to least: on 8 .24, on 9 .19, on 7 .17, on 6 .06 mm., those of 7 and 8 not reaching beyond the level of the hind margin of their respective segs., those of 9 not beyond the intersegmental membrane of 9/10, probably because the 10th seg. is stretched caudad; anal apps.: mid-dorsal .77 mm. long, apex notched to a depth of ca. .06 mm., laterals .71, inferiors .90, ratio of

length of mid-dorsal app. to length of inferiors .855. Colors: head and thorax pale yellowish brown, no distinct markings, legs not annulated, a pair of slightly darker paramedian stripes on abd. segs. 3-6, ill-defined, widest on 6, each ca. .23 mm. wide, separated by a narrower interval, 7-10 more uniformly and slightly darker, puncta and lateral scars not visible.

6ult, probably 8th instar. Total length 12.86 mm., maximum width of head 3.78, spinules on the lateral posterior dorsal angles of head and many facets on the compound eyes and so to the end of the larval period, antennae and tarsi lost, front margin of hind wing-pads .33 mm., no gonapophyses; apps.: mid-dorsal 1.06 mm., laterals 1.10, inferiors 1.18, ratio length of mid-dorsal app. to length of inferiors .90.

5ult, probably 9th instar. In fragments. Apps.: mid-dorsal .82 mm., laterals .82, inferiors .90.

4ult, probably 10th instar. Total length 21 mm., maximum width of head 4.91, antennal segments 7, front margin of hind wing-pad 1.06 mm., tarsal segs. 3-3-3 and so to the end of the larval period, gonapophyses on 8 .1 mm., on 9 .41; anal apps.: mid-dorsal 1.72, laterals 1.80, inferiors 1.88.

3ult, probably 11th instar. Total length 30 mm., maximum width of head 6.05, antennal segs. 7, length of mentum 4.34 mm., basal width 1.63, width at mid-length 2.45, distal width 3.19, front margin of hind wing-pad 2.05, gonapophyses on 9 .82; anal apps.: mid-dorsal 2.21, laterals 2.37, inferiors 2.37.

Penult, probably 12th instar. Total length 36 mm., (head damaged), antennal segments 7, length of mentum 5.32 mm., basal width 2.05, width at mid-length 3.11, distal width 3.93, front margin of hind wing-pad 3.03, gonapophyses on 9 1.15; anal apps.: mid-dorsal 1.80, laterals 2.69, inferiors 3.03.

Ultimate, probably 13th instar. Three exuviae, 2 Cartago, Feb. 23 '10, and 1 Rio d. l. Cañas: Total length 38, 35, 35 mm., maximum width of head 8.10, 6.78, 7.28, antennal segs. x , 8, 8, length of mentum 6.96, 7.12, 7.28, basal width 3.27, 2.78, 2.78, width at mid-length 3.68, 3.27, 3.27, distal width 5.07, 4.50, 4.50, distal margin with two obtuse teeth, one on each side of the ligular cleft, x , as for Cartago, pronotum with a rounded process each side, propleural supracoxal processes each of two subequal, triangular divisions, one behind the other, anterior .28 x .33 mm., posterior .28 x .38, apices acute (ca. 60°), interval between them ca. 75° ; mesopleural supracoxal processes: anterior .04 x .24 mm., posterior .19 x .28, interval between them ca. 90° , apices rounded, metapleural supracoxal processes: anterior .05 x .19, posterior .09 x .24, interval between them ca. 90° , apices rounded; hind wing-pads very divergent, their front margin 9.00, 8.18, 8.18 mm., maximum width of abdomen 7.53, 6.55, 6.55, at seg. 6, gonapophyses x , .16, 1.8, anal apps.: mid-dorsal 3.19, 3.11, 2.53, the apex transversely truncated, the male part 1.64, x , laterals 3.52, 3.60, 3.52, inferiors 3.35, 3.35, 3.52, ratio length of mid-dorsal app. to length of inferior apps. .95, .93, .72, ratio length of δ part mid-dors. app. to length of lateral apps. .47.

Colors (after alcohol): head and thorax pale clay yellow with faint, slightly darker lines on dorsum of head, a cologne earth stripe .24 mm. wide from hind

edge of each eye but not reaching to hind margin of head, a brown ochre spot on each side of pronotum, a crescentic burnt sienna mark at upper margin of propleura and of mes- and met-episterna, below this mark each episternum is pale brown, abdominal segments 1-2 pale clay yellow, 3-10 pale cadmium yellow, a dark transverse, lateral, vertical line between the metathorax and abd. seg. 1, 2-9 behind the transverse denticulated carina almost transparent white, 3-8 with a pair of paramedian brown ochre stripes, each .4 mm. wide, barely separated from each other on the mid-dorsal line, anterior end of each stripe approaching burnt sienna (= dorsal puncta), dorso-lateral puncta on 4-7, lateral puncta on 4-7, each small (.16-.32 mm.), an ill-defined pale brown spot occupying the lateral fourth of 3-9 anterior to the transverse denticulated carina.

Changes in the development of the labium are shown in our Plate XLIV; the developmental sequence of the figures of the mentum is 574, 579, 575, 582, 570, 576, 583, 581, 572, 584, 573, 571, 577, 585, 586.

I refer the only larval examples from Venezuela that I have seen to *luteipennis florida* according to my key antea page 192 rubrics 13 and 13a, figs. 578, 587, pl. XLIV. Rácenis refers imagos from the same part of Venezuela to *luteipennis luteipennis* (Anales Univ. Centr. Venez. 35: 38, 1953).

Coryphaeschna perrensi

Pl. XLV, figs. 593, 602; Map 7.

Material studied.—PANAMA: Barro Colorado Island, Canal Zone, "taken from vegetation sticking from the water of a small rain pond about 100 feet above lake level (Gatun Lake) on the northwest part of the island, June 22, 1950," by Robert B. Cumming 1 ♂ exuvia, coll. Univ. Florida.

♂. Total length ca. 52 mm. Head shape in dorsal view, including eyes, behind the clypeus (nasus), very similar to fig. 569, plate XLIV, but the mandibles much more prominent laterad, strongly convex and beset with recumbent denticles inclined forward, each denticle $.06 \pm$ mm. long. Similar denticles are on the rounded hind lateral angles of the head. Antennal segments seven. Head 6.79 mm. long, 8.68 mm. wide, hind margin 4.91 mm., straight as far as each rounded lateral angle. Distal mental margin (fig. 602, Pl. XLV) with a median (ligular) cleft .37 mm. wide at the margin and ca. .25 mm. deep, proximal half of the cleft reaching farther proximad than the level of the base of the palp; each half of the margin angulate at a spine ca. .25 mm. long, set at an angle of ca. 70° with the mid-longitudinal axis and hence divergent forward from each other. Labial palp: fixed hook truncated at apex at a right angle with a long acutely pointed spine-like tooth at the meso-posterior angle (fig. 602).

The two divisions of the prothoracic supracoxal process subequal in height (.52 mm.) and in width at base (.41 mm.) but the anterior division a little more acute at tip. Front margin of the hind wing-pad 11.12 mm. long, venation faint. Femora annulate, faded, tarsi 3-segmented.

Abdomen: maximum width 10.48 mm. at segment 6, spiracles on 2-8, lateral spines on 5-9, very short (.38 mm.) on 5. Anal appendages: mid-dorsal 4.91 mm. long, truncated almost at 90° at apex, a small tooth .08 mm. long at each lateral angle, male part less than half as long as the mid-dorsal; laterals ("cercoids") 3.68 mm., inferiors ("cerci") in ventral view 5.89 mm. Abdominal markings: two pairs of dorsal puncta on 2-8, one pair of dorso-laterals and one pair of laterals on 2-8, one pair of anterior median spots on 4-9, other abdominal markings faded.

Ecology.—For a note on the ecology of the Barro Colorado Island exuvia see under *C. perrensi* adult page 175 *antea*.

Coryphaeschna viriditas Calvert, Pl. XL, fig. 535, Pl. XLV, figs. 591, 592, 599, Pl. XLVII, figs. 607, 610, 614; Map 7.

1943. *Coryphaeschna virens* Geijskes, Ent. News 54 (3): 68, figs. 2A-F (entire ♂ nymph, antenna, mentum & palps, ♀ gonapophyses, apex of abdomen ♀ ♂).¹

Material studied.—GUATEMALA: Los Amates, Dept. Izabal, Jany., 1905, E. B. Williamson in his coll. 1 ♂ larva. PANAMA: Culebra, Canal Zone 1 ♀ exuvia, coll. Williamson, U.M. BRITISH GUIANA: Georgetown, probably from canals adjacent to the town, not collected by E. B. W(illiamson) but his property, 1 ♂ larva UM; Wismar, on reeds in flat above swamp, 1 ♀ exuvia, coll. Wllmsn. UM. BRAZIL: Belem, Para, "From igarape in woods. Found on a leaf, Aug. 1, 1922", J. H. Williamson, 1 ♂ exuvia, coll. Wllmsn., UM. L[agoa] Taniape, Fortaleza, Ceara, 3 ♀ larvae, coll. Needham (1 ♀ given to P. P. C.); Nova Teutonia, Sta. Catharina, March, 1936, F. Plaumann, 2 ♂, 2 ♀ larvae, coll. P. P. C. Total 4 ♂, 5 ♀ larvae, 1 ♂, 2 ♀ exuviae.

Total length ♂ 51.75-17 mm., ♀ 50-18.5 (Fortaleza 3 ♀ 50-26). Head, maximum length 7.54-2.70, maximum width 10.18-3.11, hind margin 6.22-2.97. The hind margin of the head is nearly straight in each lateral fifth of its length, concave in the middle three-fifths, the depth of the concavity being from 1.4 to .08 mm. in the median line from the largest to the smallest individuals. Antennal segments seven. Labium when folded at rest reaching to the level of the hind margin of the second or of the third coxa; mentum: total length 12.91-3.27, sides subparallel from base to slightly more than mid-length, thence diverging to apex, basal width 3.11-1.02 mm., width at mid-length 3.76-1.39, distal width 6.95-2.08; distal margin with two acute spines, each .5-.057-0.76 mm. long, one on each side of a usually open median (ligular) cleft from which it is distant by .10-.13 mm.; the distal mental margin is angulated at each spine (except in the Belem and three smaller Nova Teutonia examples; the ligular cleft .57-.076 mm. deep, .06-.025 mm. wide at the margin; the distal mental margin in the Belem example closely approaches a straight line, in the Los Amates and Fortaleza specimens it is markedly arched at each spine and more so in those from Fortaleza than in those from Guiana. Labial palps: the three Fortaleza examples show these differences among themselves: the smallest has the

proximal segment (fixed hook) squarely truncated, the next in size (37 mm. long) less squarely truncated and the outer distal angle more rounded the largest nearly of the obliquely truncated form shown in fig. 599, Pl. XLV, for the Wismar specimen.

Pronotum, maximum width 6.38-2.40 mm.; in the largest *Fortaleza* example it is divided by two transverse carinae into three areas (the first carina convex anteriorly, the second concave anteriorly), the mid-dorsal longitudinal dimensions of the three areas are, respectively, .75, 1.23 and .57 mm.; a brownish mid-dorsal line on the anterior two areas; from the point where this line meets the second carina a less-marked carina runs on each side obliquely laterad and caudad to behind the mesostigma. The second transverse carina described above terminates in a lateral rounded process .8 mm. long in ventral view.

On the propleura two supracoxal processes, rounded at the apices, one behind the other, the anterior the smaller, .33 mm. high (*Fortaleza*), .5 mm. wide at base, the posterior .41 x .65 mm., the two processes separated by an angular interval of 90° in dorsal view. On the mesopleura a sub-horizontal longitudinal carina with a slight notch above the middle of the second coxa, which notch apparently corresponds to the interval between the two propleural supracoxal processes. On the metapleura a similar subhorizontal longitudinal carina with a still slighter notch above the third coxa. In the *Belem* exuvia the two propleural supracoxal processes are markedly unequal in length (anterior .28 mm., posterior .61 mm. long = high) and in width at base (.42 and .76 mm., respectively), all these measurements in dorsal view.

Hind wing pads reach to the middle of abd. seg. 4, their front margin 11.86-11.12 mm. long (larger specimens), or middle of seg. 1 (smaller where their front margin is 1.47-.90 mm. long), their venation not distinct even with the addition of alcohol, wing rudiments within the pads not crumpled in individuals 22-17 mm. long, crumpled in those 50 mm. long. Hind femur 7.45 mm. in the largest specimen, femora and tibiae pale, femora with a brown dot at 2/3 length (diffuse dots, *Belem*), tibiae with a brown spot at 1/3 length (unspotted in the smallest *Fortaleza* example). Tarsi 3-3-3-segmented.

Abdomen: total length 33 mm., maximum width 10 mm. at seg. 6 to 4.66 mm. at 6, spiracles visible on 2- or 4-8, obscured by debris on others; gonapophyses ♂ .33-.12 mm., ♀ 2.03-.50 mm., reaching to half-length, or entire length of the sternum of seg. 9. Lateral spines on segs. 6-9 or 5-9 or 4-9, shortest on the most anterior (.1-.038 mm.). Anal apps.: mid-dorsal 4.91-1.31 mm. long, its apex squarely truncated with a minute spine at each lateral angle of the truncation, roundly excavated to a maximum depth of .16 mm. at the middle, exceeding the level of the apices of the lateral apps. by .38-.57 mm., length of the male part 1.90-1.64 mm., greater than its basal width. Lateral apps. 5.73-.82 mm., inferiors 6.22-1.88 mm.

Colors of alcoholic larvae except where otherwise stated. The general body color ranges from pale clay yellow to gamboge to pale cadmium yellow to brown pink to brown ochre (Smith's Glossary, pl. IV, nos. 22, 18, 20, 21, 36).

Head in lateral view with a pale brown longitudinal stripe through the eye, continued caudad as a vandyke brown stripe .66 mm. wide, to the hind margin of the head and thence as a much paler stripe (ill-defined in some) on the thoracic pleura. On the dorsal surface of the head the area of the compound eyes of the imago is purplish, or dark olive green, or cologne earth, with diffuse brownish markings between the eyes.

On the most anterior area of the pronotum two straight, transverse, pale brown streaks; on each side of the middle area a wider, curved, transverse, pale brown stripe; mesal end of each mesostigma outlined in sepia in strong contrast to the surrounding cadmium yellow.

Abdomen in Fortaleza examples with irregular, minute, longitudinal, pinkish flecks, hindmost fifth of segs. 3-10 pale greenish, each lateral half thereof with 10-12 irregular, longitudinal, more or less broken brown lines; a mid-dorsal blackish hair-line on 2-9, fainter on 2 and on 9, interrupted at the base of 4-8 by a paler yellow oblong spot .74 mm. long x .5 mm. wide, hind end pointed, bounded by a dark reddish brown line except at the anterior end; about at far behind this oblong spot as the spot is long is the single pair of transverse, linear dorsal puncta of Walker 1912 on 5 and 6, abbreviated on 7 and 8; dorso-lateral puncta present as dots on 6-8, lateral puncta present and larger on 2-9, lateral scars not prominent. Both dorsal and ventral surfaces of the abdominal segments with numerous pale setae up to .19 mm. long, arranged in irregular longitudinal rows.

In the smaller examples from Nova Teutonia, ranging in length from 22 to 17 mm., the abdominal markings are as follows: a pair of subdorsal brown ochre spots, varying in diffuseness, on 1-7 or -8, or on 1-10, forming a mid-dorsal stripe 1.14-1.39 mm. wide, these spots somewhat in a V (open cephalad) on 3-8, or on 5- or 6-7, or not well marked, on 5-7 smaller, on 8 much larger, more remote from each other on 8 and 9 or on 9 and 10, or not remote on 8-10; dorsal puncta on 1-7 or 3-7, but not distinct in all specimens; dorso-lateral puncta on 3-7 or 4-7, or 3 and 4; lateral puncta on 1-6 or -7, or 2-7, or 3-8; lateral scars on 4-8, or not prominent; in some individuals each of the brown ochre spots on 3- or 5-8 contains a larger anterior and a smaller posterior dorsal punctum.

The Belem exuvia shows two pale paramedian longitudinal stripes not as wide as the mid-dorsal brown (= the black hair-line of Fortaleza) separating them, other markings not evident.

Abdominal markings in the Culebra exuvia obscured by attached debris.

The very pale, almost uncolored Wismar exuvia has a pale brown mid-dorsal stripe .9 mm. wide on 3- or 4-8 and a pair of darker spots (anterior dorsal puncta) on 4-8, dorso-lateral and lateral puncta faint.

Discussion.—The range in total length of the ultimate exuviae referred to this species is slight: Culebra 47 mm., Wismar 48, Belem 48 mm., the greatest interval separating any successive two of

them 3.75 mm. This range and this greatest interval do not suggest that more than one species is involved. The largest Fortaleza larva, a female of 50 mm. total length, fits in well in the exuvial series. The other two female larvae from Fortaleza, 37 and 26 mm. long respectively, may each represent a different instar. The Nova Teutonia larvae range from 17 to 22 mm. ♂ and 18.5 to 22 mm. ♀ in total length, with two intervening males of 21 mm.; all these larvae may well belong to the same instar. Our material as a whole may, therefore, represent four different instars. Cf. Calvert, Proc. Amer. Phil. Soc. 68, page 256, table 4, 1929, and 73, pages 2, 8-9, tables I and III, 1934, for *Anax junius*.

The most noteworthy differences among the material here referred to *viriditas*, not explicable as representing stages of growth or development, are the shape of the distal mental margin and the degree of difference in length of the two supracoxal propleural processes. If these differences indicate that more than one species is involved, I know of no other imago to which they might be referred.

The nymph of *virrens* described by Geijskes¹ has the head as long as broad while our material has it shorter than wide and more coloring on the legs.

Coryphaeschna ingens (Rambur) Pl. XL, fig. 536, Pl. XLV, figs. 589, 590, 598; Map 7.

1919. *Coryphaeschna ingens* Kennedy, Ent. News 30 (4): 106, figs. 1-3 (entire ♂ larva, apex of ♂ abd., rear of head & prothorax).¹

1925. *Coryphaeschna ingens* Brimley, Ent. News 36 (3): 85.²

1930. *Coryphaeschna ingens* Byers, Univ. Florida Publ. Biol. Sci. Series 1 (1): 253, 254, fig. 10 (habitat sketch), Pl. VI, fig. 105 (landscape showing marsh-pond conditions).³

1955. *Coryphaeschna ingens* Needham & Westfall, Manual Drgfls. N. Amer.: 280, 279, fig. 169 (entire larva).⁴

Material studied.—NORTH CAROLINA: Carteret Lodge Pond, Beaufort, June 20, 1934, A. S. Pearse, 1 ♀ exuvia (damaged). FLORIDA: Monticello, Aucilla River, 10.4.1931, 1 ♀ larva, Miccocukee Lake, 1.17.31, 1 ♀ larva, in Jefferson County; Half Moon Lake, 2.9.39, 1 ♀ + 1 other larva, Newman's Lake, II.22.1928, 1 ♂ larva, Gainesville, IV. 1930, 2 ♀ larvae, in Alachua County, Jan. 10, 1931, 1 ♂, 1 ♀ larvae, 4.1928, 1 ♂ exuvia, May, 1938, 1 ♀ exuvia, Bivan's arm of Paynes Prairie, 4.4.1930, 1 ♀ larva, in Alachua County, cypress swamp in Monroe County 1 ♂ larva, all by C. F. Byers, in coll. Byers except 1 ♂ larva given to P. P. C. Total 3 ult exuviae (1 ♂, 2 ♀), 3 ♂, 7 ♀ + 1 other larva = 14.

Changes in size among these larvae and exuviae are as follows: Total length ♂ 42-57, ♀ 30.5-56, undifferentiated 22 mm.; maximum length of head ♂ 5.73-8.50, ♀ 5.65-8.48, und. 3.68; maximum width of head ♂ 7.20-9.15, ♀ 5.81-9.15, und. 3.88; hind dorsal margin of head ♂ 6.63-6.79, ♀ 7.20-7.28, more or less concave, depth of concavity at the mid-dorsal line ♂ .57-.82, ♀ .49-.90; antennal segments 7; mentum length ♂ 11.-14., ♀ 8.18-14.40, und. 4.91; basal width ♂ 2.36-2.45, ♀ 1.72-2.83, und. 1.23, width at mid-length ♂ 2.37-2.64, ♀ 1.80-2.83, und. 1.27, distal width ♂ 4.91-6.79, ♀ 3.85-6.22, und. 2.46; sides of mentum subparallel or slightly convergent in the basal half, thence diverging rapidly to, or almost to, the apex, in the latter case subparallel in their extreme end; distal margin with two acute spines, each .33-.66 mm. long, one on each side of the open ligular cleft; labium at rest reaching to, or nearly to, the level of the hind margin of the third coxae; labial palps with the fixed hook tapering from its base to its acute apex, being 1.22-1.41 mm. long on its concave posterior margin, the tapering beginning at the level of the distal mental spine of the same side; in older larvae the fixed hook is obliquely truncated (figs. 590, 598, Pl. XLV) at apex, its posterior mesal angle prolonged into a very acute spine; in the undifferentiated larva it is truncated at apex almost at 90° (fig. 589), its posterior mesal angle produced into an acute spine about $\frac{3}{4}$ as long as the width of the fixed hook exclusive of the spine. Movable hook of the labial palps, 3.30-3.77 mm. long on its posterior concave margin, reaching almost to the lateral edge of the base of palp of the opposite side: pronotum, maximum width 3.76-6.51, a lateral process each side .25-.49 long, propleural supracoxal processes: anterior .02 x .19 mm.—.20 x .49 mm., posterior .05 x .19—.33 x .76 mm., apices of both processes approximating 90°, that of the anterior less rounded in most cases than that of the posterior, interval between them 90°-120°, but in the smallest larva ca. 140°; mesopleural supracoxal processes represented by a longitudinal sub-horizontal carina with a shallow notch above the middle of the second coxa corresponding to the interval between the two propleural processes, immediately behind this notch an angular projection whose apex is 70°-130° and whose length is .09-.19 mm.; metapleural supracoxal processes similar to, but less marked than, those of the mesopleura. Hind wing-pads reaching to the hind margin of the metanotum (smallest larva)-hind margin of abd. seg. 4, their front margin .98-12.85 mm. long, wing-rudiments within the hind wing pads subequal thereto, smooth, *i.e.*, not crumpled, tarsal segments 3-3-3. Abdomen, maximum width 3.72-9.72 mm., gonapophyses ♂ .38-.66, ♀ .49-2.95, not reaching to the apex of 9, lateral spines on segs. 6-9, shortest (.08-.94 mm.) on 6; anal apps.: mid-dorsal ♂ 4.00-5.65, ♀ 3.27-5.97, undifferentiated 1.80, its apex .47-.57 mm. wide, squarely truncated, often with a minute tooth at each lateral angle, exceeding the apices of the lateral apps. by .08-.57 mm. (at the level of those apps. in undif. larva) ♂ part 1.39-1.98 mm. long, basal width \bar{x} -1.60 mm., lateral apps. ♂ 4.25-6.22, ♀ 3.19-6.55, undif. 2.00, inferiors ♂ 4.75-6.71, ♀ 3.85-6.95, undif. 2.13. Ratio of length of mid-

dorsal app. to length of inferior apps. ♂ .842, ♀ .846-.859, undif. .845. Ratio of length of ♂ part of mid-dorsal app. to length of lateral apps. .318-.327.

Colors of alcoholic specimens as per Plate IV of Smith's Glossary: in most pale clay yellow, in fewer pale cadmium yellow; head with two reddish brown lines on each side of the dorsum parallel to the eye-margins, or these lines represented by faint markings but with a brown ochre or blackish spot, .16 mm. in diameter, at or near the level of the hind end of each eye and .33-.82 mm. mesad thereof; in lateral view the head has a dark brown, or brown ochre, or vandyke brown, longitudinal stripe through the eye; behind the eye this stripe is .25-.65 mm. wide and in some is continued on to the thoracic pleura and the abdomen; that portion of this stripe on the head behind the eye is in some composed of alternate pale and dark, oblique, parallel lines, as if corresponding to internal muscle fibers; abdomen with a mid-dorsal, or two paramedian, longitudinal pale brown stripes on segments 1-10 (as continuations, in some, of dorsal thoracic stripes), discrete on 1-5, coalescent on 6 or more posteriorly; the mid-dorsal stripe (or two paramedians together) measure 1.00-2.36 mm. wide on 5 and 6 and are narrower both anteriorly and posteriorly; one ♂ larva shows a mid-dorsal blackish hairline on 3-7, interrupted at the bases of 4-7 by an oblong yellowish spot 4 x 3 mm.; in another larva (the undifferentiated) the mid-dorsal line is clay yellow; hindmost seventh to fourth of most of the segments paler than the rest of each segment, even greenish, and has longitudinal brown or blackish lines or stripes each side of the mid-dorsal stripe (or paramedian stripes); a lateral longitudinal brown ochre stripe on 1- or 2-8 or -9 or -10 .71-3.30 mm. wide on 4, narrower, or of subuniform width, on the others; dorsal puncta not distinct in the majority of specimens studied, present on 5-8 or 5-7 but small; dorso-lateral puncta not found in the majority or present on 5-9, 5-8, or 6-8 as minute black dots; lateral puncta absent from some, or present on one or more of segments 3-10; in two they are elongated, in others dots; the lateral scars are confused with the lateral stripes in one larva, they have not been distinguished in the others but are distinct on segs. 2-8 of two exuviae.

Discussion.—The absence from our material of any exuviae other than the three ultimate makes it impossible to definitely group our material by instars. The smallest larva, that of indeterminate sex, 22 mm. long, is doubtless of a different instar from that of any other larva as it is separated by a difference in length of 8.5 mm. from the next largest. Two Florida larvae, being of the same length as the three ultimate exuviae, must belong to the ultimate larval instar. One Florida larva, 4 mm. shorter than these two, is separated by 2 mm. from the next smallest larva and this in turn by 2 mm. from the next smallest. The following shortest interval is but 1 mm., then follows a gap of 7 mm., which probably indicates the occurrence of a moult.

These considerations make it probable that at least three different, but not necessarily consecutive, instars are represented in our material, our smallest larva possibly of the 6ult instar.

Compared with Kennedy's description¹ of this larva, the present material is smaller, 56-57 mm. vs. 65 mm. long, maximum width of abdomen 9.72 vs. 10 mm. Brimley's nymph² is of nearly the same size as our material. Byers describes³ a coal black nymph with white markings. Needham & Westfall's figure⁴ illustrates some of the color variations of our material.

III. RELATIONSHIPS OF THE NEOTROPICAL AESCHNAS TO THE NORTH AMERICAN FOSSILS

In North America some fossil dragonflies have been found and it is desirable to learn whether they can be related to neotropical forms in a way similar to that followed by Simpson 1950* and others in mammals. No fossil dragonflies are known from Central or South America.

These fossil forms are 1. *Aeschna solida* Scudder 1890,† 2. *Ae. separata* Scudder 1890, 3. *Ae. larvata* Scudder 1890 and 4. *Lithaeschna needhami* Cockerell 1907.‡

1. *Aeschna solida* was referred to his (Cockerell's) new genus *Hesperaeschna* by Cockerell in 1913.§

2. *Aeschna separata* was referred to *Hoplonaeschna* by Needham in 1903¶ and by Cockerell in 1908.** Except for the unlocated locality Trogas del Oro, Mexico, in the original description of *Aeschna armata* Hagen 1861, *Hoplonaeschna* is not recorded from the neotropical region and hence does not enter into the present discussion.

3. Of *Aeschna larvata* I can say nothing.

* Simpson, G. G., 1950, History of the Fauna of Latin America, American Scientist 38(3): 361-389.

† Scudder, S. H., 1890, Rept. U. S. Geol. Surv. Territ. (F. V. Hayden) Washington, Govt. Printing Office, pp. 143 et seq., pl. 13, fig. 1.

‡ Cockerell, T. D. A., 1907, Bull. Amer. Mus. Nat. Hist. xxiii, pp. 133-136, fig. 1 (hind wing).

§ Cockerell, T. D. A., 1913, Proc. U. S. Nat. Mus. 45 (2000), p. 581.

¶ Needham, J. G., 1903, Proc. U. S. Nat. Mus., xxvi (1331), p. 762, pl. xxxviii, fig. 1 (*Hoplonaeschna armata* wings).

** Cockerell, T. D. A., 1908, Amer. Journ. Sci., xxvi, p. 74.

Three characters used for the separation of the recent subgenera in our key, antea pages 9-16: the presence or absence of a ventral tubercle on abdominal segment 1, the color pattern of the thorax, the superior anal appendages and three following sexually restricted characters of the males: the postero-ventral tergal angles of abd. seg. 1, the glans penis and the anal triangle of the hind wing are not available for any of the four fossils.

On applying our key to the venational data for *solida*, *solida* runs to rubrics 1, 2 (genus *Aeshna*) or 2a, 3 (subgenus *Aeshna*) or 3a, 5 or 5a (*Marmaraeschna*) or 6, 7 (*Hesperaeschna*). Mrs. H. K. Gloyd, at my request, kindly likewise applied our key to Scudder's figure and description of *solida* and independently reached the same conclusions as to the relationships of *solida* to these genera and subgenera.

The description of the hind wing of *solida* given by Cockerell in 1908 Ent. News xix: 455-459, is not sufficiently full to enable it to be compared in detail with the hind wings of the type species of related genera (*grandis* for *Aeshna*, *californica* for *Hesperaeschna*, *multicolor* for *Schizuraeschna*, *intricata* for *Marmaraeschna*). We are forced, therefore, to base all our studies on the front wing. The figure of the hind wing to which Cockerell referred on page 459, line 2 seems not to have been published.

On making a minute comparison of the venation of *solida*, 18 features agree with, and 16 differ from *H. californica*, 14 agree with and 20 differ from *Ae. grandis*, 10 agree with and 6 differ from *S. multicolor*, 9 agree with and 6 differ from *M. intricata*. *A. solida* by this count is nearest to *Hesperaeschna*, then in succession to *Aeshna*, *Schizuraeschna* and *Marmaraeschna* in number of agreements. From the generotypes of these four subgenera *solida* differs from *H. californica* by 10 characters, from *Ae. grandis* by 7 characters, from *M. intricata* by 4 and from *S. multicolor* by 3.

The characters studied are the number of supratrangular cross-veins, the total cells in the discoidal triangle, the number of cells at its proximal side and on its outer side, the number of cells in the internal triangle and of cubital cross-veins excluding the internal triangle, the level where two rows of cells begin between M1 and M2; the maximum number of rows of cells between the successive veins from R1 to the hind wing-margin, the number of rows between M1 and M2 at the

wing-margin, of short sectors between M1 and M2 distad of the level of the stigma, of branches of Cu2 at the wing-margin, of branches of Rspl and of M4spl to the wing-margin, of cells surmounted by the stigma, of postnodals; the position of the fork of Rs.

Since, as has been stated above, no fossil South American Aeshnas have been found, we must base our ideas of the relations of the South American subgenera to each other and to the North American forms on morphological and geographical data. The closeness of relationship of the Miocene *Aeshna solida* of Florissant to the South American subgenera and genera is, in decreasing order, *Hesperaeschna*, *Aeshna*, *Schizuraeschna*, *Marmaraeschna*, *Coryphaeschna*, *Castoraeschna* and, least of all, *Neureclipta*. The present northern limits of these subgenera and genera are *Schizuraeschna* 52° and *Hesperaeschna* 49° North Latitude in British Columbia, *Coryphaeschna* 34° N. L. in North Carolina, *Marmaraeschna* 16° N. L. in Mexico, *Neureclipta* 7° South Latitude in Ecuador and *Castoraeschna* 11° S. L. in Peru. The southernmost limits of these groups are *Schizuraeschna* 8° S. L. in Panama and Venezuela, *Hesperaeschna* 53° 5' in Tierra del Fuego, *Coryphaeschna* 32° S. L. in Brazil, *Marmaraeschna* 36° S. L. in Chile, *Neureclipta* 40° S. L. in Chile and Argentina, *Castoraeschna* 27° 11' S. L. in Brazil. The latitudinal ranges of these groups are *Hesperaeschna* 102°, *Coryphaeschna* 66°, *Schizuraeschna* 60°, *Marmaraeschna* 52°, *Neureclipta* 47°, *Castoraeschna* 37°. *Hesperaeschna* reaches farther south than any other group and is exceeded only by 3° in reaching farthest north and throughout this range its distribution as a group is continuous. It possesses a larger number of species and subspecies than any of the other subgenera or genera. As a group it would appear to be the most adaptable to various environmental conditions. Its great continuous distribution suggests that it may antedate the interruption to North American land continuity at Panama which geologists have placed in the Eocene to Miocene (Scharff 1912 * pp. 237-238) or Pliocene (Darrah 1945).† As the land connection at

* Scharff, R. F., 1912, *Distribution and Origin of Life in America*, New York, Macmillan Company, pp. xvi, 497.

† Darrah, W. G., 1945, *A Geological Sketch of Central America and the Antilles*, Plants & Plant Science in Latin America, Chronica Botanica Co., Waltham, Mass., pp. 153-156.

Panama was restored in the Miocene or Pliocene (Marcus 1933 * p. 138, W. B. Scott 1937 † pp. 120-121, Darrah 1945), it is conceivable that the continuous distribution of *Hesperaeschna* may postdate the Panama emergence. This would give the Pliocene as the possible date of *Hesperaeschna* in Mexico, Central America and South America and subsequent to the Miocene date of *Aeschna solida* at Florissant. At least eleven authors have accepted the idea of an additional Cenozoic interoceanic passageway at the Isthmus of Tehuantepec, but the latest investigators of this subject, Durham, Arellano and Peck 1955 affirm that "There is no evidence whatsoever for any post-Mesozoic seaway through this immediate area," p. 990. Earlier paleogeographical changes than those of the Pliocene can not be used to determine the ages of the neotropical *Aeshnas* owing to the absence of Central and South American fossils.

The nine known species and subspecies of *Coryphaeschna* are, with one exception (*C. ingens*, Florida to North Carolina), confined to the neotropical region, where they range from Mexico to Argentina. This suggests a southern origin for the genus but there seems to be no evidence as to their age relative to each other.

All five species of *Castoraeschna* are South American and here also there seems to be no evidence as to their age relative to each other.

All four species and subspecies of *Neureclipta* are South American and the same remark as to their age is to be made.

Eigenmann's lines of argument for ages of fresh-water fishes can not be used for the Odonata (*Aeshna* et al.) because the fresh-water fishes are confined to the water at all stages of their free-living lives whereas the Odonata are independent of water in their adult period.

Altitudes at which *Aeshnas* may be found will determine the temperatures at the places of collection, and the temperatures in turn will determine the plants which grow there, the plants will determine the insects which feed on them and some of these insects may serve as food for *Aeshnas*. We still know too little to be able to say for any species

* Marcus, E., 1933, Tiergeographie, Potsdam, Akad. Verlagsgesell Athenaion MBH, pp. 81-106.

† Scott, W. B., 1937, A History of Land Mammals in the Western Hemisphere, Revised Edition, New York, Macmillan Company, pp. xvi, 786.

of *Aeshna* what temperatures affect its survival in the localities of collection. The power of flight of the *Aeshnas* enables them to cross barriers which limit the distribution of many other groups. Thus, *Ac.* (*Hesperaeschna*) *marchali* has been found at 800 meters (2625 feet) and 3500 m. (11483 ft.) elevations in Colombia (Ris 1913 † p. 83). Such species as *Hesperaeschna cornigera cornigera*, *psilus*, *confusa*, *peralta* and *Schizuraeschna jalapensis* have been found both west and east of the Andes.

IV. RELATIONS OF THE SOUTH AMERICAN AESHNAS TO PALAEARCTIC AND AUSTRALIAN SPECIES

Ris (1904 * p. 28) remarked (translated): It is worth mentioning that these three species (*Ae. diffinis*, *bonariensis*, *variegata*) look at first sight, extraordinarily like the European species of the group *mixta-borealis-affinis*. The likeness in *Ae. affinis* is increased still more in that here a very similar single brown Ausfärbungsform exists such as is known in *bonariensis* and *confusa*. Nevertheless the likeness certainly does not rest upon internal (i.e., genetic) relationship (which would be an unsolvable zoogeographical puzzle) . . . In the Europeans the tubercle of the first abdominal segment is lacking and the type of the frontal marking is totally different.

In many of the European *Aeschnas* the ventral surface of abdominal segment 1 (where the spinulose tubercle is found in neotropical *Hesperaeschnas*) is flat but has a median spinulose area.

In 1913 Ris † added (translated) The likeness to *Ae. mixta*, *affinis*, *coerulea*, *brevistyla* is doubtless a pure convergence.

Erich Schmidt (1950‡ pp. 5-6) pointed out that the near-eastern and mediterranean *Aeschna isosceles* O. F. Müller 1767 (translated) has small carinae on abdominal segments 7-8 and similarly *Ae. diffinis* and *bonariensis* have them on segments (4-) 5-8, but made no reference to their possible zoogeographical relations.

* Ris, F., 1904, Odonaten, Hamburger Magalhaensische Sammelreise, Hamburg, L. Friederichsen & Co., pp. 1-44.

† Ris, F., 1913, Neuer Beitrag zur Kenntniss der Odonatenfauna von Argentina, Mem. Soc. Ent. Belg. xxii, pp. 55-102.

‡ Schmidt, E., 1950, Was ist Libellula . . . isosceles O. F. Müller 1767?, Ent. Ztschr. 60 (1/2), pp. 1-9.

Aeshna brevistyla Rambur, of Australia, Tasmania and New Zealand, judging by Tillyard's *Insects of Australia and New Zealand*, 1926, pl. 4, fig. 4, and Martin's *Aeschnines*, Cat. Colls. Zool. Selys-Longchamps, fasc. XVIII, 1908, p. 53, fig. 50, agrees with the venational and appendageal characters of the genus *Aeshna* and of the subgenus *Aeshna* as we have stated them antea, pages 9, 18 (specimens of *brevistyla* are not accessible at this writing), except that the subnodal sector (Rs) forks at the level of the proximal end of the pterostigma.

Of the authors who have treated of groups of plants or of animals with representatives in two or three of the southern continents—South America, Africa, Australia with New Zealand—the following have accepted, as explanations of their presence, the land connection of these continents with the Antarctic Continent: Bray 1900* for plants, Fraser 1940† for the Neopetalinae (Odonata), Kusnekov 1949‡ for two species of *Monomorium* (ants), Marcus 1933§ for mammals but also palaeobotanically and geologically, Paramonov 1955¶ for Cyrtidae (Diptera), Scharff 1912** for fresh-water mussels and fresh-water crayfishes and Scott 1937†† for mammals.‡‡ Eigenmann on the contrary has opposed (1921)§§ or doubted (1923)¶¶ the explanation of

* Bray, W. L., 1900, The relations of the North American Flora to that of South America, *Science*, New Series 12 (306), pp. 709-716, Nov. 9.

† Fraser, F. C., 1940, A Reclassification of the Order Odonata based on some New Interpretations of the Venation of the Dragonfly Wing by R. J. Tillyard, Continuation and Conclusion by F. C. Fraser, *Australian Zoologist*, ix (iv), page 377.

‡ Kusnekov, N., 1949, El genero *Monomorium* (Hymenoptera, Formicidae) en la Argentina, *Acta Zool. Lilloana*, Tucuman, 7, pp. 423-448, 1 map.

§ Marcus, E., 1933, Tiergeographie. Sonderdruck aus dem Handbuch d. geographischen Wissenschaft, Potsdam, Akad. Verlagsgesell. Athenaion MBH, page 139.

¶ Paramonov, S. J., 1955, New Zealand Cyrtidae and the problem of the Pacific island fauna, *Pacific Sci.* 9 (1); pp. 16-25.

** Scharff, R. F., 1912, *Distribution and Origin of Life in America*, New York, The Macmillan Co, page 425.

†† Scott, W. B., 1937, *A History of Land Mammals in the Western Hemisphere*, New York, The Macmillan Co., revised edition, rewritten throughout, pp. 121-122, 262.

‡‡ For a survey of the literature up to 1934 on this subject, see Wittmann, O., *Zoogeographica* 2, pp. 246-304, Jena, 1934.

§§ Eigenmann, C. H., 1921. The Nature and Origin of the Fishes of the Pacific Slope of Ecuador, Peru and Chili, *Proc. Amer. Phil. Soc.*, LX (4), p. 522.

¶¶ Eigenmann, C. H., 1923, The Fishes of the Pacific Slope of South America, etc., *Amer. Nat.* 57, pp. 200-203.

the distribution of fresh-water fishes by land connections with Antarctica.

V. THE GEOLOGICAL AGE AND GEOGRAPHICAL DISTRIBUTION OF THE ANCESTORS OF THE ODONATA AND OF THE MAMMALIA

The Odonata as a group date back to the Lower Lias and are supposed by Brongniart (1893 * p. 394) to have descended from the Protodonata which geologically are Carboniferous and Lower Permian and geographically are known from Kansas, England, France and Russia.

The Mammalia as a group date back to Upper Triassic or Lower Jurassic and are supposed by W. K. Gregory (Encyc. Brit. 1953, vol. 14, pp. 753-754, 976) to have descended from mammal-like reptiles, the cynodonts. D. M. S. Watson (art. Reptiles, op. cit. vol. 19, p. 187) puts the sub-order Cynodontia, of the top of the Permian and Lower Trias, under the order Theriodontia and the latter under the super-order Theromorpha, page 186. The Theromorpha range from the Upper Carboniferous to the Upper Trias and geographically are known from Russia, Mongolia and South Africa.

VI. RELATIONS OF THE NEOTROPICAL AESHNAS TO EACH OTHER

Neureclipta is farthest removed morphologically from *Aeshna* (*Hesperaeschna*) *solida*, and except for *Castoraeschna*, farthest removed geographically. *Castoraeschna* and *Neureclipta* have the smallest latitudinal range of all the genera and subgenera treated in this paper. Some other South American Aeshninae not discussed here and some North American genera are listed below and are enclosed in parentheses. P after a character means More Primitive, L Less Primitive, based solely on morphological considerations.

Abdominal segment 1 with no ventral tubercle P: *Aeshna*, *Corrhophaeschna* (*Allopetalia*); this tubercle present L: *Hesperaeschna*, *Rhionaeschna*, *Marmaraeschna*, *Neureclipta*, *Castoraeschna*.

Supratrangular cross-veins present P?: *Aeshna*, *Hesperaeschna*, *Rhionaeschna*, *Schizuraeschna*, *Marmaraeschna*, (*Boyeria*, *Oplonaeschna*, *Basiaeschna*, *Allopetalia* hind wings, *Gynacantha*, *Triacantha*-

* Brongniart, C., 1893, Recherches pour servir a l'Histoire des Insectes Fossiles des Temps Primaires, Sainte-Etienne, Imprimerie Theolier et Cie 4to, p. 394.

gyna, *Subaeschna*, *Neuraeschna*, *Staurophlebia*; these cross-veins absent L?: *Neureclipta*, (*Gomphaeschna*, *Allopetalia* front wings).

Mid-dorsal longitudinal carina present on abdominal segment 10 of males P: *Aeshna* some, *Hesperaeschna*, *Rhionaeschna*, *Schizuraeschna*, *Marmaraeschna*, *Neureclipta*, (*Basiaeschna*, *Neuraeschna*; this carina absent L: *Aeshna* some, *Coryphaeschna* except *C. secreta*, (*Gomphaeschna*, *Boyeria*, *Triacanthagyna*, *Subaeschna*, *Gynacantha*, *Staurophlebia*).

Superior appendages of the males in lateral edge view (see anteà page 12) not bifid apically P: *Aeshna*, *Hesperaeschna*, *Rhionaeschna*, *Marmaraeschna*, *Neureclipta*, *Neuraeschna* except *N. costalis*, *Staurophlebia*, *Boyeria*, *Allopetalia*, *Basiaeschna*, *Triacanthagyna*, *Subaeschna*, *Gynacantha*; these appendages in lateral edge view bifid apically L: *Schizuraeschna*, (*Neuraeschna costalis*).

Anal triangle of hind wings of males 2-celled P: *Coryphaeschna*, *Castoraeschna*, (*Gomphaeschna*, *Basiaeschna*); 3-celled L: *Hesperaeschna*, *Rhionaeschna*, *Schizuraeschna*, *Marmaraeschna*, *Neureclipta*, (*Allopetalia*, *Triacanthagyna*, *Subaeschna*, *Neuraeschna*, *Staurophlebia*); 2- or 3-celled P: *Aeshna*; 3-5-celled L (*Boyeria*, *Gynacantha*).

Internal triangle 1-celled P: *Rhionaeschna*, (*Boyeria*, *Allopetalia* front wings, *Basiaeschna*; 2-celled L: *Hesperaeschna*, (*Triacanthagyna*, *Subaeschna*, *Allopetalia* hind wings or front and hind wings, *Gynacantha*, *Neuraeschna*, *Staurophlebia*).

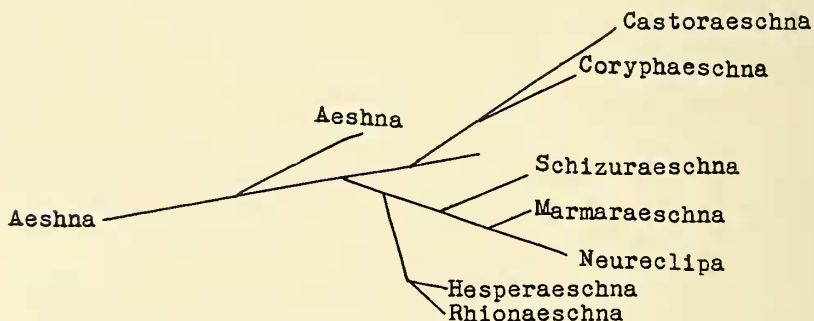
Subnodal sector (Rs) not forked P: (*Gomphaeschna*, *Basiaeschna*, *Boyeria*, *Allopetalia reticulosa*; forked proximal to, or at least at the level of the proximal end of, the stigma L: *Aeshna*, (*Subaeschna*, *Gynacantha*, *Allopetalia armata*, *Neuraeschna*, *Staurophlebia*, *Castoraeschna*; forked under the stigma or at the level of the proximal end thereof L: *Coryphaeschna*).

Rows of cells between the fork of Rs: P compare the preceding character; 3 or more L: *Aeshna*; 3 L: (*Gynacantha*, *Neuraeschna*, *Staurophlebia*); 2 L: *Coryphaeschna*, (*Subaeschna*); 3, 4, or rarely 2 L: *Castoraeschna*.

Proximal side of the discoidal triangle of the hind wings: usually but not always longer than $\frac{1}{2}$ the length of the posterior side P: *Aeshna*, (*Gomphaeschna*, *Hoplonaeschna*, *Basiaeschna*, *Allopetalia*); half as long L: *Gynacantha aratrix*; usually but not always shorter than half

the length of the posterior side L: *Coryphaeschua*, *Castoraeschua*, (*Boyeria*, *Subaeschua*, *Neuraeschua*, *Staurophlebia*).

The relations of the neotropical *Aeshnas* dealt with in the present paper may be further illustrated by the accompanying diagram modified from Walker's phylogenetic tree of 1912.



Walker's Phylogenetic Tree (1912, page 24) Limited to Genera and Subgenera treated in the present paper.

VII. THE SEASONAL DISTRIBUTION OF THE NEOTROPICAL SPECIES OF AESHNA

The occurrence of the imagos of the neotropical species of *Aeshna* in respect to their seasons of flight (wet or dry) is given below. The data available are, doubtless, very imperfect and the chief usefulness of this list is to serve as a basis for further investigations in the countries concerned.

I have not been successful in finding any correlations between the seasonal distribution of these species and other elements of their ecology, unless it be that the subgenus *Hesperaeschua*, which we have seen, on geographical grounds, to be the most adaptable of all those here considered, is represented by a large number of species (ten) as flying in both wet and dry seasons.

A. Species flying in the Wet Season: *Hesperaeschua haarupi* (Argentina), *H. decessus* (Rio d. Jan.), *Schizuraeschua multicolor* (Mex.), *Sch. jalapensis* (Mex., Guat., Costa Rica), *Marmaraeschua vigintipunctata* (Argent., Bolivia), *M. pallipes* (Argent.), *Neureclipa diffinis* (Peru, not Chile), *N. galapagoensis* (Galap.), *N. bonariensis* (Argent., Uruguay, Brazil), *Coryphaeschua luteipennis* (as a species),

C. l. florida (Mex., Colombia), *C. perrensi* (Canal Zone, E. Peru, W. and S. E. Brazil), *Castoraeschna januaria* (Brazil), *Ca. castor* (Brazil), *Ca. colorata* (Brazil).

B. Species flying in the Dry Season: *Hesperaeschna peralta* (Chile, between seasons elsewhere), *H. biliosa* (Ecuador between two maximal rainfall seasons), *Marmaraeschna brevifrons* (Mex. to Chile and Paraguay) *Neureclipta diffinis absoluta* (Peru), *N. elsia* (Chile), *Coryphaeschna secreta* (Cuba), *C. perrensi* (Mex.).

C. Species flying in both Wet and Dry Seasons: *Hesperaeschna californica* (California, February wetter to July drier), *H. williamsoniana* (Mex. wetter to Panama drier), *H. confusa*, *H. cornigera cornigera*, *H. cornigera planaltica*, *H. psilus* (Mex., Costa Rica), *H. marchali* (Ecuador), *H. joannisi* (Colombia to Bolivia), *H. punctata*, *H. variegata*, *Neureclipta diffinis diffinis* (Chile see above), *Coryphaeschna luteipennis luteipennis* (Brazil), *C. rufipennis* (Peru), *C. ingens* (Florida), *C. viriditas*, *C. adnexa*, *Castoraeschna coronata*.

D. Species whose seasonal distribution is not stated: *Aeshna unicolor*, *Ae. rufipes*, *Rhionaeschna maieta*.

EXPLANATION OF PLATES

Unless otherwise stated, all drawings were made under a Zeiss binocular microscope, Greenough model, with camera lucida or from eye-piece micrometer measurements, and by Elsie Lincoln Rosner. The abbreviations indicating the museums and collections in which the figured specimens are contained are given on pages 1 and 2.

PLATE I. *Adnexa* Hagen, *Coryphaeschna*

Figs. 1 and 2, left profile and dorsal views of apex of male abdomen; iap, sp, inferior and superior appendages.

Fig. 3, dorsal view of top of frons, male.

Fig. 4, membranule of right hind wing from below, male; A, anal vein, bat, basal side of anal triangle.

Fig. 5, thoracic pattern, left side, female.

as, antealar sinus	ies3, metinfraepisternum
dc, dorsal carina	insu, vestigial interpleural (first lateral) suture
em2, mesepimeron	msu, mesopleural (humeral) suture
em3, metepimeron	mtu, metapleural (second lateral) suture
es2, mesepisternum	sp2, mesothoracic spiracle (mesostigma)
es3, metepisternum	sp3, metathoracic spiracle (metastigma)
ies2, mesinfraepisternum	

Fig. 6, tip of penis, ventral view.

Fig. 7, second abdominal segment, ventral view, male.

al, anterior lamina	lm, left margin of genital fossa
au, auricle	ph, posterior hamule
gl, genital lobe	rm, right margin of genital fossa
hf, hamular fold of anterior hamule	sh, sheath of penis
hp, hamular process of same	sp, spine of anterior lamina

Figs. 8 and 9, left profile and ventral views of apex of female abdomen.

an, anal lamina (sternum of 11th abdom. segment)
ap, appendages (cercoids) of 10th abdom. segment
bp, basal plate
gv, genital valve (lateral gonapophysis of 9th abdom. segment)
lp, lateral genital plate
ov8, gonapophysis of 8th abdom. segment
ov9, mesal gonapophysis of 9th abdom. segment (ov8 and ov9 together form the ovipositor)
spl, spinules on the sternum of 10th abdom. segment
st, stylus of genital valve

Fig. 10, left profile view of penis.

gl, genital lobe	1, 2, 3, 4, segments of the penis; 1 also
im, intersegmental membrane	known as the vesicle of the penis;
II, III, 2nd and 3rd abdom. segments	4 also as the glans

Fig. 11, Sixth abdom. segment, left side, male; the capital letters indicate pale spots; AL, ML, PL, antero-, medio- and postero-lateral, MD and PD medio- and postero-dorsal.

im, intersegmental membrane lc, lateral carina

tc, median transverse carina

Figs. 1, 2 and 7 from Samana, Hayti, Mus. Comp. Zool.; 3, 6, 10 and 11 from Guantanamo, Cuba, by Dr. Henry Skinner, II.13.14; 4 from Paramaribo, Dutch Guiana, by D. C. Geijskes, Nov. 6, 1938; 5, 8, and 9 from Guayaquil, Ecuador, by Prof. F. Campos R., nos. 33 and 122.

Figs. 502, 503, Plate XXXVII, of the first and second abdominal segments of *Coryphaeschna viriditas* will serve also for *C. adnexa*. See Fig. 505 of the same plate for an enlarged left profile view of the glans penis of *adnexa*.

PLATE II. *Biliosa* Kennedy, *Aeshna* (*Aeshna*)

Figs. 12 and 13, left profile and dorsal views of apex of male abdomen.

Figs. 14 and 16, ventral and left profile views of apex of female abdomen, allotype.

Fig. 15, dorsal view of top of frons, male.

Fig. 17, second abdominal segment, ventral view, male.

Fig. 18, sixth abdominal segment, left side, male.

Fig. 19, second abdom. segment, left side, male.

Fig. 20, glans penis, ventral view.

Fig. 21, thoracic pattern, left side, male.

Fig. 22, left profile view of penis.

All the specimens figured are from Baños, Ecuador, 1900 meters, or its vicinity, by W. C. MacIntyre, colls. C. H. Kennedy and Calvert, the allotype shown in figs. 14 and 16 (coll. Kennedy) is from El Tablon, 2000 m., 28.X.38, the original of fig. 18 (P. P. Calvert del.) is dated 14.V.39, of fig. 19 6.VI.39, Runtun Lake.

PLATE III. *Bonariensis* Rambur, *Aeshna* (*Neureclipta*)

Figs. 23 and 24, left profile and dorsal views of apex of male abdomen.

Fig. 25, dorsal view of top of frons, male.

Fig. 26, thoracic pattern, left side, female.

Figs. 27 and 28, ventral and left profile views of apex of female abd.

Figs. 29 and 30, sixth abdom. segment, left side, male and female respectively.

Figs. 31, 35 and 36, second abdom. segment, left side, female and two males respectively.

Figs. 32 and 33, glans penis, ventral views.

Fig. 34, second abdominal segment, ventral view, male.

Fig. 37, left profile view of penis.

The originals of figs. 23-25 and 34 are from Rio de la Plata, Mus. Comp. Zool. no. 113; of figs. 26, 30 and 31 from Sapucay, Paraguay, 8.1. and 25.1.1903, colls. U.S.N.M. and Calvert; of fig. 27 from São Paulo, Brazil, Feb., 1937, by F. Wucherpfennig, coll. Cowley; of fig. 28 from Buschental, Uruguay, Feb., 1935, coll. Cowley; of figs. 29 and 35 from Nova Teutonia, Brazil, 7 Feb., by F. Plaumann, coll. Calvert; of fig. 32, after treatment with KOH, from San Cristobal, 19 Feb., 1920, of figs. 33, 36 and 37 from Alto de Serra, 11 March, 1920, the last two in Argentina, coll. Needham. Figs. 27 and 28 by Miss Eleanor Bareiss, figs. 31, 32, 33, 35 and 36 by P. P. Calvert, 33 under compound microscope.

PLATE IV. *Brevifrons* Hagen, *Aeshna* (*Marmaraeschna* Calvert 1952)

Figs. 38 and 39, left profile and dorsal views of apex of male abdomen. There is a very slight break in the infero-mesal margin of the left superior appendage in the specimen drawn, as shown in fig. 38.

Figs. 40, 41, dorsal views of top of frons, male and female.

Fig. 42, entire male, Hagen's type.

Fig. 43, second abdominal segment, left side, male.

Fig. 44, right wings, Hagen's female allotype.

Fig. 45, thoracic pattern, left side, male.

Figs. 46, 47, two sketches of top of frons, Hagen's type male and female allotype, by Dr. Joseph C. Bequaert. In reference to Fig. 46 Dr. Bequaert wrote, May 8, 1947: "In the male from Acapulco the 'infusate' areas are poorly defined and not uniformly tinted. Perhaps you would not call them markings."

Fig. 48, glans penis, ventral view.

Fig. 49, second abdominal segment, profile of left ventral edge, male.

Fig. 50, sixth abdominal segment, left side, male.

Fig. 51, second abdominal segment, ventral view, male.

Fig. 52, left profile view of penis.

Figs. 53 and 54, ventral and left profile views of apex of female abd.

The original of figs. 38-40, 45, 50 and 51 is from Arequipa, Peru, in coll. A.N.S.P.; of figs. 41, 53 and 54 from the same locality in the Mus. Comp. Zool.; of figs. 42 and 46 from Acapulco, Mexico, Hagen's type in Mus. Comp. Zool.; of figs. 43, 48 and 52 from Taltal, Chile, 20.I.1942, in coll. Needham; of figs. 44 and 47 from Valparaiso, Chile, Hagen's female allotype in Mus. Comp. Zool.; of fig. 49 from Matucana, Peru, May 27, 1920, in Mus. Zool. Univ. Mich. figs. 42 and 44 from photographs by Frederick P. Orchard. Figs. 43 and 48 by P. P. Calvert, 48 under comp. microsc. Fig. 52 by Eleanor Bareiss.

PLATE V. *Californica* Calvert, *Aeshna* (*Hesperaeschna*)

Fig. 55, entire male.

Fig. 56, sixth abdominal segment, left side, female.

Fig. 57, thoracic pattern, left side, female.

Fig. 58, left hind wing, 58a, base of abdomen, 58b, head, mesothorax and base of right fore wing, all of female.

Figs. 59 and 60, ventral and left profile views of apex of abdomen, female.

Fig. 61, first and second abdominal segments, ventral view, male.

Figs. 62 and 63, left profile and dorsal views of apex of male abdomen.

Fig. 64, ventral view, apex of penis.

Fig. 65, dorsal view of top of frons.

Fig. 66, left profile view of penis.

Originals of Figs. 55, 56 and 59 (appendages only) from Sunnyside, Washington, May 25, 1903, by Prof. C. H. Kennedy, in coll. Calvert; of figs. 57, 59 (except appendages), 60-66 from Olympia, Washington, June, 1895, by Prof. Trevor Kincaid; of fig. 58 from Seattle, Washington, July 6, 1892, probably by Prof. O. B. Johnson. Figs. 55, 58-58b from photographs by Mr. A. Delwin Warden.

PLATE VI. *Castor* Brauer, *Castoraeschna* Calvert 1952

Figs. 67 and 68, left profile and dorsal views of apex of male abdomen.

Figs. 69 and 72, dorsal views of top of frons, *castor* male and *Coryphaeschna luteipennis luteipennis* female for comparison.

Fig. 70, sixth abdominal segment, left side, female.

Fig. 71, ventral view, apex of penis.

Fig. 73, thoracic pattern, left side, male.

Fig. 74, left profile view of penis.

Figs. 75 and 76, first and second abdominal segments, ventral view, male and female.

Figs. 77 and 78, left profile and ventral views of apex of female abdomen.

Originals of Figs. 67-69 and 75 from "Umgegend von Rio", Brazil, in Mus. Comp. Zool., with two labels in de Selys' hand, on green paper; "P Br" and "Ae. lunulata" (see text); of figs. 70 and 72 from S. Paulo, Brazil, March, 1937, by F. Wucherpfennig, in coll. Cowley; of figs. 71, 73 and 74, from Rio de Janeiro, Brazil, Sept. 25, 1922, by Jesse H. Williamson, in coll. A.N.S.P.; of figs. 76-78, from Südhg. Itatiaya-Gebrg. [South hills, Itatiaya Mts.], 700 m., Rio de Janeiro, Brazil, Zikan collector, 9.xii.1926, am Licht [at light], in coll. Dr. Erich Schmidt. Fig. 70 by Leonard M. Pakman, 72 by P. P. Calvert.

PLATE VII. *Colorata* Martin, *Castoraeschna*

Figs. 79 and 80, left profile and dorsal views of apex of male abdomen.

Figs. 81 and 82, dorsal views of top of frons, male and female; dotted lines in 81 show fractures.

Fig. 83, left profile view, ventral margin of first abdominal segment inverted, female type.

Fig. 83a, ventral view, first abdominal segment and anterior part of second segment, female type.

Fig. 84, thoracic pattern, left side, female type.

Figs. 85 and 86, second abdominal segment, left side, male and female.

Fig. 87, sixth abdominal segment, left side, male.

Figs. 88 and 89, ventral and left profile (of ventral margin) views of first and second abdominal segments, male.

Figs. 90 and 90a, ventral and left profile views of apex of abdomen, female.

Original of all figures of the male from Lagoa Olho d'Agua, Brazil, Abril de 1949, by Dr. Newton Dias dos Santos, no. 13645; of the female from Ypiranga, Brazil, Martin's type, in coll. Needham. Palp (stylus) of the genital valve of female apparently lost after drawings were made. Figs. 79-81, 83a, 85-89 by P. P. Calvert.

PLATE VIII. *Confusa* Rambur, *Aeshna* (*Hesperaeschna*)

Figs. 91 and 92, left profile and dorsal views of apex of male abdomen.

Figs. 93 and 96, second abdominal segment, left side, female and male.

Fig. 94, dorsal view of top of frons, male.

Fig. 95, thoracic pattern, left side, male.

Fig. 97, glans penis, ventral view.

Figs. 98 and 99, ventral and left profile views of apex of female abd.

Fig. 100, second abdominal segment, ventral view, male.

Fig. 101, left profile view of penis.

Fig. 101a, sixth abdominal segment, left side, male.

Originals of figs. 91, 92, 94 and 100 from Montevideo, Uruguay, in U. S. N. M., no. 114; of 93 from Talca, Chile, i.1905, in coll. A. N. S. P.; of 95, 96 and 101a from Nova Teutonia, Sta. Catarina, Brazil, Dec. 1, 1936, by F. Plaumann in coll. Cowley; of 97 and 101 from the same locality, date and collector in coll. Kennedy; of 98 and 99 from Montevideo, Uruguay, in coll. U. S. N. M., no. 122. Figs. 93, 96 and 97 by P. P. Calvert, 97 under comp. microsc., 101 by Eleanor Bareiss.

PLATE IX. *Cornigera cornigera* (Brauer), *Aeshna* (*Hesperaeschna*)

Figs. 102 and 103, left profile and dorsal views of apex of male abd.

Figs. 104, 105 and 106, dorsal and two profile views of superior appendages of male (asymmetrical).

Figs. 107-109, thoracic patterns, left side, two males and one female.

Figs. 110 and 111, dorsal views of top of frons, male and female.

Fig. 112, sixth abdominal segment, left side, female.

Figs. 113 and 116, glans penis, ventral views.

Fig. 114, second abdominal segment, ventral view, male.

Fig. 115, left spine of anterior lamina, mesal surface; same scale as fig. 114.

Fig. 117, left profile view of penis.

Figs. 118 and 120, ventral and left profile views of apex of female abd.

Fig. 119, dorsal view of left abdominal appendage, female.

Originals of figs. 102, 103, 110 and 114 from Colombia by Moritz in Mus. Comp. Zool. no. 185; of 104-106 from Pallatanga, Ecuador, by Prof. F. Campos R., no. 61; of 107 from El Volcan Chiriqui, Panama, 4.iii.1936, by W. J. Gertsch, in coll. A. M. N. H., no. 211; of 108, 113 and 117 from Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia, 4500 feet, July 16, 1920, by Rehn & Hebard, in coll. A. N. S. P. no. 237; of 109, 111 and 112 from vicinity of Balsas, Rio Marañon Andes, Dept. Cajamarca, Peru, 1179 m. above sea level, June 25, 1936, by Felix Woytkowski, in Univ. Mich. Mus. Zool.; of 115 from Santa Marta Mts. trail, Colombia, Dec. 30, 1916, by J. H. & E. B. Williamson, in Univ. Mich. Mus. Zool.; of 116 from Vista Nieve, Cincinnati Trail, Magdalena, Colombia, July 21, 1920, by Rehn & Hebard, in coll. A. N. S. P., no. 240; of 118 and 120 from Venezuela in Mus. Comp. Zool., no. 188; of 119 from Cincinnati, Colombia, July 28-29, 1920, by Rehn & Hebard, in coll. A. N. S. P., no. 238. Figs. 107, 113 and 116 by P. P. Calvert, 113 under comp. microsc. 116 after Borror's treatment with KOH, drawn in glycerine on the same scale as fig. 32, Pl. III, of *bonariensis*; 117 by Eleanor Bareiss.

PLATE X. *Cornigera planaltica* Calvert 1952 (and figs. 133 and 134
c. cornigera), *Aeshna* (*Hesperaeschna*)

Figs. 121 and 122, left profile and dorsal views of apex of male abd.

Figs. 123-126, thoracic patterns, left side, four males.

Fig. 127, dorsal view of top of frons, male.

Fig. 128, first and second abdominal segments, ventral view, male.

Figs. 129 and 130, ventro-posterior and latero-ventral views of left hamular process, male, more enlarged than in fig. 128.

Figs. 131 and 132, second abdominal segment, left side, male and female.

Figs. 133 and 134, ventral and left profile views of apex of female abdomen of *cornigera cornigera*.

Fig. 135, sixth abdominal segment, left side, male.

Originals of figs. 121, 122, 126-128 from Buschental, Dept. San José, Uruguay, Dec., 1934, by H. Schneider, in coll. Cowley; of 123 from Naranpata, Ecuador, by Prof. F. Campos R., no. 41, in coll. Calvert; of 124 from Rio de Janeiro, Brazil, in coll. A. M. N. H., no. 216; of 125, 129, 130, 131, 132, and 135 from Nova Teutonia, Santa Catarina, Brazil, Dec. 1, 1935, by F. Plaumann, nos. 226, (holotype ♂) 224, in coll. Calvert; of 133 and 134 from vicinity of Balsas, Rio Marañon, Andes, Dept. Cajamarca, Peru, 1179 m., June 25, 1936, by Felix Woytkowski, in coll. Univ. Mich. Mus. Zool. Figs. 124, 131 and 132 by P. P. Calvert.

PLATE XI. *Coronata* Ris, *Castoraeschna*, Figs. 136-144; *diffinis* *diffinis* Rambur, *Aeshna* (*Neureclipta*), Figs. 145-152

- Figs. 136 and 137, left profile and dorsal views of apex of male abdomen.
 Fig. 138, second abdominal segment, ventral view, male.
 Fig. 139, glans penis, ventral view.
 Fig. 140, left profile view of penis.
 Fig. 141, dorsal view of top of frons, male.
 Fig. 142, thoracic pattern, left side, male.
 Fig. 143, sixth abdominal segment, left side, male.
 Fig. 144, second abdominal segment, left side, male.
 Figs. 145 and 146, left profile and dorsal views of apex of male abdomen of *diffinis diffinis*.
 Figs. 147-149, left superior abdominal appendage of three males, n, o, p, dorsal views; all three males have the pale mesepimeral stripe visible and the identifications may therefore be considered certain.
 Fig. 150, glans penis, ventral view.
 Fig. 151, left profile view of penis.
 Fig. 152, first and second abdominal segments, ventral view, male.

Originals of all figures of *coronata* from Satipo, Peru, by Pedro Paprzycki, in colls. C. H. Kennedy and Calvert, of figs. 136, 137, 140-144 spmn. no. 2, 14 Nov., 1940, of fig. 138 spmn. no. 4, 16 May, 1940, of fig. 139 spmn. no. 5, 10 June, 1940. Figs. 136, 137, 140-142 by Eleanor Bareiss, 138, 139, 143 and 144 by P. P. Calvert; 139 under comp. microsc. with lower lens of the objective removed, the dotted lines show internal structures. Originals of figs. 145, 146 and 152 from Quilpué, Chile, by René Martin in coll. Calvert; of 147-149 from Santiago, Chile, Nov., 1940, by Cervantes, in coll. Kennedy; of 150, 151, from Villa Alemana, Chile, by René Martin in coll. Calvert, no. 172. Figs. 147-151 by P. P. Calvert, 150 under comp. microsc. with lower lens of the objective removed.

PLATE XII. *Diffinis diffinis* Rambur, *Aeshna* (*Neureclipta*)

- Figs. 153 and 158, dorsal views of top of frons, females; sides of the stem of the T-spot not symmetrical in the insect shown in fig. 153.
 Figs. 154 and 155, thoracic patterns, left side, females.
 Figs. 156 and 157, sixth abdominal segments, left side, females.
 Fig. 159, second abdominal segment, left side, male.
 Fig. 160, base of abdomen of female, dorsal view.
 Figs. 161 and 162, ventral and left profile views of apex of abdomen of female.
 Figs. 163 and 164, ventral and left profile views of apex of abdomen of female.
 Fig. 165, second abdominal segment, left side, male.

Originals of figs. 153, 154, 156, 159, 161, 162 and 165 from Villa Alemana, Chile, by René Martin, in coll. Calvert, females nos. 167, 168 and 179, male no. 172; of 155, 157, 163 and 164 from Baños de Cauquenes, Chile, in coll.

U. S. N. M., no. 202; of 158 and 160 from Valparaiso, Chile, in Mus. Comp. Zool., no. 204, type of *configurata* Hagen 1855 (not described). Figs. 153, 154, 159 and 165 by P. P. Calvert.

PLATE XIII. *Diffinis diffinis* Rambur, *Aeshna* (*Neureclipta*)

Figs. 166 and 167, left profile and dorsal views of apex of male abd.

Fig. 168, dorsal view of top of frons, male.

Fig. 169, thoracic pattern, left side, female.

Fig. 170, base of abdomen of female, dorsal view.

Figs. 171 and 172, second abdominal segment, left side, male and female.

Fig. 173, glans penis, ventral view.

Fig. 174, second abdominal segment, ventral view, male.

Fig. 175, left profile view of penis.

Figs. 176 and 177, ventral and left profile views of apex of abdomen of female.

Fig. 178, sixth abdominal segment, left side, male.

Originals of figs. 166-170, 174, 176 and 177 from Montevideo, Uruguay, in Mus. Comp. Zool., male no. 132, female no. 133; of 171-173, 178 from Buschental, Dept. San José, Uruguay, by H. Schneider, in coll. Cowley, male Feb., female 7 Dec., both 1935. Figs. 171-173 by P. P. Calvert, 173 under comp. microsc., lower lens of objective removed, fig. 175 by Eleanor Bareiss, fig. 178 by Leonard M. Pakman.

PLATE XIV. *Diffinis absoluta* Calvert 1952., *Aeshna* (*Neureclipta*)

Figs. 179 and 180, left profile and dorsal views of apex of male abd.

Fig. 181, dorsal view of top of frons, male.

Fig. 182, thoracic pattern, left side, male.

Figs. 183 and 184, second abdominal segment, left side, male and female.

Fig. 185, metasternum, first and second abdominal segments, ventral view, male.

Fig. 186, apex of penis, ventral view.

Fig. 187, left profile view of penis.

Figs. 188 and 189, ventral and left profile views of apex of abdomen, female.

Figs. 190 and 191, sixth abdominal segment, left side, male and female.

Originals of all figures from Concepcion, Peru, April 7 & 8, 1935, by Felix Woytkowski, holotype male and allotype female, in Univ. Mich. Mus. Zool.

PLATE XV. *Dugesi* Calvert, *Aeshna* (*Schizuraeschna* Calvert 1952)

Figs. 192 and 194, left profile and dorsal views of apex of male abd.

Fig. 193, left edge view of left superior appendage, male.

Fig. 195, dorsal view of top of frons, male.

Fig. 196, thoracic pattern, left side, male.

Fig. 197, glans penis, ventral view; ALM as in fig. 201.

Figs. 198, 199, sixth abdominal segment, left side, male and female.

Fig. 200, second abdominal segment, ventral view, male; insect oriented so that the teeth of the right and left auricles are in the same focus; this has resulted in making the right and left spines of the anterior lamina and the hamules somewhat asymmetrical in position.

Fig. 201, left profile view of penis; ALM, anterior angle of lateral margin, D, dorsal lobe of glans; compare figs. 197 above and 220A and 220B, pl. XVI.

Fig. 202, first and second abdominal segments, left side, male; numerous hairs on dorsal surface omitted to show color pattern more clearly; unshaded and very lightly shaded areas bluish to yellowish, shaded areas brown below to black above.

Fig. 203 omitted.

Originals of all figures from Davis Mts. Granger's Cañon (Limpia Cañon), three miles north west of Fort Davis, Texas, June 25, 1931, by Leonora K. Gloyd, male and female in colls. Calvert and Univ. Mich. Mus. Zool. All figures by P. P. Calvert.

PLATE XVI. *Elsia* Calvert 1952, *Aeschna* (*Neureclipsa*)

Figs. 204 and 205, left profile and dorsal views of apex of male abd.

Figs. 206 and 212, thoracic pattern, left side, male and female.

Fig. 207, dorsal view of top of frons, male.

Figs. 208-210, sixth abdominal segment, two males, one female.

Fig. 211, base of abdomen of female, dorsal view.

Fig. 213, second abdominal segment, ventral pattern, male; contents of genital fossa omitted.

Figs. 214 and 215, second abdominal segment, left side, male and female.

Figs. 216 and 217, ventral and left profile views of apex of female abd.

Fig. 218, first and second abdominal segments, ventral part of left side, male; t ventral tubercle of the first segment; unshaded areas pale blue, shaded brown (Van Dyke brown on I, pale brown on II—Smith's Glossary, pl. iv), a black line on dorsal margin of auricle.

Fig. 219, second abdominal segment, ventral view, male.

Fig. 220, left profile view of penis.

Figs. 220A and 220B, glans penis, ventral and left profile views. In figs. 220-220B the letters D and LM indicate, respectively, the dorsal lobe and the thin membranous lateral margin of the glans; the dorsal lobe is naturally not visible in fig. 220A. In fig. 220 the dorsal lobe is pressed more closely against the penultimate, or third, segment of the penis (Borror's 1942 numeration) than in fig. 220B. All three figures are made from dry penes and show some of the differences to be found in dry material. The penis shown in fig. 220 is not protruded as far as is shown for many other species.

Originals of figs. 204, 205, 218, 219 from Curico, Chile, in Mus. Comp. Zool., no. 124; of 206, 210, 211, 214, 216, and 217 from Villa, (vicinity), Dept. Lima, Peru, 120 meters, March 15, 1936, by Felix Woytkowski, in coll. Univ. Mich. Mus. Zool.; of 207-209, 213, 215, 220 and 220A from the vicinity of Pacasmayo,

Peru, May 20, 1936, same collector and museum, 207, 208 and 213 from holotype male no. 2222, 209, 220 and 220A from paratype male no. xix, 215 from allotype female no. 2222; of fig. 212 from Mini-Mini, Chile, coll. Needham; of 220B from vicinity of Reparticion, Dept. Lima, Peru, 140 meters, Feb. 28, 1935, by Felix Woytkowski, in coll. Univ. Mich. Mus. Zool. no. q9. Figs. 206, 212-218, 220A and B by P. P. Calvert, 220A and B under comp. microsc., lower lens of objective removed; 220 by Eleanor Bareiss.

PLATE XVII. *Galapagoensis* Currie, *Aeshna* (*Neureclipsa*)

- Figs. 221 and 222, left profile and dorsal views of apex of male abdomen, superior appendages broken after drawing was made.
 Figs. 223 and 224, base of abdomens, dorsal views, female and male.
 Fig. 225, dorsal view of top of frons, female.
 Fig. 226, venation of female type.
 Fig. 227, second abdominal segment, ventral view, male.
 Fig. 228, tip of penis, ventral view.
 Fig. 229, left profile view of penis.
 Figs. 230 and 231, ventral and left profile views of apex of female abdomen, type.
 Fig. 232, sixth abdominal segment, left side, male.

All figures of the male from spmn. no. 171, Chatham Is., Galapagos, by U(nited) S(tates) F(ish) C(ommission) in U. S. N. M.; of the female from the type no. 5419, from Chatham Is., Galapagos, May 26, 1899, in U. S. N. M. Fig. 226 from photograph by Herman A. Walters, 232 by Leonard M. Pakman.

PLATE XVIII. *Haarupi* Ris, *Aeshna* (*Hesperaeschna*)

- Figs. 233 and 234, left profile and dorsal views of apex of male abdomen.
 Fig. 235, left profile view of penis.
 Fig. 236, glans penis, ventral view.
 Fig. 237, second abdominal segment, left side, male.
 Fig. 238, dorsal view of top of frons, male.
 Fig. 239, thoracic pattern, left side, male.
 Fig. 240, second abdominal segment, ventral view, male.
 Figs. 241 and 242, ventral and left profile views of apex of female abdomen.
 Fig. 243, sixth abdominal segment, left side, male.

Originals of figs. 233-236, 238-240 and 243 from Mendoza, Argentina, May 11, 1908, and of 241 and 242 from Ch[acras] de Coria, Mendoza Province, Argentina, Dec. 7, 1907, in coll. Univ. Mich. Mus. Zool.; of 237 from Tafi del Valle, Argentina, 10.xii.47, by Golbach, in coll. F. C. Fraser. Figs. 233-235, 238-243 by Leonard M. Pakman, 236 and 237 by P. P. Calvert, 236 under comp. microsc.

PLATE XIX. *Ingens* Rambur, *Coryphaeschna*

Figs. 244 and 245, left profile and dorsal views of apex of male abd.

Figs. 246 and 247, ventral and left profile views of apex of female abd.

Fig. 248, second abdominal segment, left side, female.

Fig. 249, glans penis, ventral view, terminal piece protruded.

Fig. 250, thoracic pattern, left side, male.

Fig. 251, second abdominal segment, ventral view, male.

Figs. 252 and 253, posterior and dorsal views of tip of same penis, terminal piece only slightly protruded in 252, not protruded in 253.

Fig. 254, left profile view of penis of same male as in figs. 252 and 253, terminal piece only slightly protruded.

Fig. 255, dorsal view of top of frons, male.

Fig. 256, sixth abdominal segment, left side, male.

Fig. 257, dorsal view of apex of right abdominal appendage, female.

Originals of figs. 244, 245, 250, 255, 256, 257 from Fort Myers, Florida, March 4, 10 and 11, 1921, by J. H. Williamson, in colls. Calvert and Cowley; of figs. 246-248, 251-254 from Royal Palm State Park, Florida, Feb. 28, 1927, by Dr. Frank Morton Jones, in coll. Calvert; of 249 from Lake Okeechobee, Florida, 1886, by the Heilprin Expedition of A. N. S. P. Figs. 248 and 249 by P. P. Calvert, 249 under comp. microsc.; 250 by Eleanor Bareiss, 256 by Leonard M. Pakman.

PLATE XX. *Intricata* Martin, *Aeshna* (*Marmoraeschna*)

Figs. 258 and 259, left profile and dorsal views of apex of male abd.

Figs. 260 and 263, dorsal views of top of frons, male and female.

Figs. 261 and 262, thoracic patterns, two males; dotted lines in 261 show "perhaps limits of air-sacs (Luftsäcke)" (E. Schmidt).

Figs. 264 and 265, sixth abdominal segment, male and female.

Figs. 266 and 267, second abdominal segment, left side, male and female.

Fig. 268, tip of penis, ventral view.

Fig. 269, second abdominal segment, ventral view, male.

Fig. 270, left profile view of penis.

Figs. 271 and 272, right-ventral and left profile views of apex of female abdomen.

Originals of figs. 258-260, 262, 264, 266, 268-272 from Tarma, Peru, May 31, 1920, by J. H. Williamson, in coll. Univ. Mich. Mus. Zool.; of 261 from "Bolivia" in Mus. Paris, male no. 2; of 263, 265, 267 from vicinity of Concepción, Peru, April 7 & 8, 1935, Felix Woytkowski, in coll. Univ. Mich. Mus. Zool. Fig. 261 by Dr. Erich Schmidt, 266 and 267 by P. P. Calvert, 271 and 272 by Eleanor Bareiss. See also pls. XXXVI and XXXVII.

PLATE XXI. *Jalapensis* E. B. Williamson, *Aeshna* (*Schizuraeschna*)

Figs. 273 and 274, left profile and dorsal views of apex of male abd.

Fig. 275, dorsal view of top of frons, male.

Fig. 276, sixth abdominal segment, left side, male.

Figs. 277 and 278, second abdominal segment, left side, male and female.

Figs. 279 and 280, ventral and left profile views of apex of female abd.

Fig. 281, second abdominal segment, ventral view, male.

Fig. 282, left profile view of penis.

Fig. 283, tip of penis, ventral view.

Fig. 284, thoracic pattern, left side, male.

Originals of figs. 273-277, 281 and 284 from Cartago, Costa Rica, May 14, 1909, by P. P. Calvert, in his coll.; of 278 from San Sebastian, Retalhuleu, Guatemala, in coll. Cowley; of 279, 280 from San José, Costa Rica, 1.6.29, by M. Valerio, in coll. Calvert; of 282 and 283 from Cachí, Costa Rica, tank in cafetal, March 9, 1910, by P. P. Calvert, in his coll. Figs. 277 and 278 by P. P. Calvert.

PLATE XXII. *Januaria* Hagen, *Castoraeschna*

Figs. 285 and 286, left profile and dorsal views of apex of male abd.

Fig. 287, first and second abdominal segments, ventral view, male.

Fig. 288, sixth abdominal segment, left side, male.

Fig. 289, second abdominal segment, left side, male; this is the only male I have which has preserved the colors of this segment and possibly not all of the segment shows the natural colors.

Fig. 290, left profile view of penis.

Fig. 291, tip of penis, ventral view.

Fig. 292, thoracic pattern, left side, male.

Fig. 293, first and second abdominal segments, left side, female.

Originals of all figures from Nova Teutonia, Santa Catarina, Brazil, Nov. 20, 1934 (except fig. 289 Jan. 10, 1935?), by F. Plaumann, in coll. Calvert.

Fig. 288 by Leonard M. Pakman, 289 and 293 by P. P. Calvert.

PLATE XXIII. *Januaria* Hagen, *Castoraeschna*, Figs. 294-296, and *joannisi* Martin, *Aeshna*, Figs. 297-307

Fig. 294, first and second abdominal segments, ventral view, female.

Figs. 295 and 296, ventral and left profile views of apex of female abd.

Figs. 297 and 298, left profile and dorsal views of apex of male abdomen of *Ae. joannisi*.

Fig. 299, tip of penis, ventral view.

Fig. 300, left profile view of penis.

Figs. 301 and 302, dorsal views of top of frons, female holotype and male.

Figs. 303 and 304, sixth abdominal segment, male and female.

Fig. 305, second abdominal segment, ventral view, male.

Figs. 306 and 307, thoracic pattern, left side, male and female; the dotted lines added to the metepimeron in fig. 306 to show the lower end of the outline of the yellow stripe in the Abitagua male, but not as clearly visible in the Popayan male.

Originals of figs. 294-296 from Nova Teutonia, Santa Catarina, Brazil, Nov. 20, 1934, by F. Plaumann, in coll. Calvert; of 297-300, 302, 303, 305 and 306 from Popayan, Cauca, Colombia, in coll. Needham; of fig. 301 from "Bolivie", Martin's female holotype; of 304 and 307 from San Antonio [Bolivia?], Martin's female paratype, both in Mus. Nation. d'Hist. Nat. Paris. Figs. 301, 304 and 307 by Dr. Erich Schmidt.

PLATE XXIV. *Longfieldae* Kimmins, *Castoraeschna* figs. 308-310, and *luteipennis* Burmeister, *Coryphaeschna*, figs. 311-322

Figs. 308 and 309, left profile and dorsal views of apex of male abd.

Fig. 310, first and second abdominal segments, ventral view, male.

Figs. 311 and 312, left profile and dorsal views of apex of male abdomen of *C. luteipennis*.

Fig. 313, dorsal view of top of frons, male.

Fig. 314, thoracic pattern, left side, male.

Fig. 315, dorsal view of top of frons, female; see also fig. 72, pl. VI.

Fig. 316, tip of penis, ventral view.

Fig. 317, first and second abdominal segments, left side, male. This male has had the lateral margins of the genital fossa spread apart so that the genital lobes, right and left, are folded mesad and somewhat dorsad and do not show in profile view; they might therefore give the impression that the genital lobes are lacking in this species, which is not the case.

Fig. 318, sixth abdominal segment, left side, male.

Fig. 319, left profile view of penis.

Fig. 320, second abdominal segment, ventral view, male.

Figs. 321 and 322, ventral and left profile views of apex of female abd.; styli in original of fig. 321 broken off, replaced in the figure by one from original of fig. 315.

Originals of figs. 308-310 from Chapada, Matto Grosso, Brazil, 19.6.27. by Miss. C. Longfield, in Brit. Mus. (Nat. Hist.); of 311, 312, 316, 319 and 320 from Santa Gallo, [Rio de Janeiro?] Brazil, by Dr. Teuscher, Thayer Exped., in Mus. Comp. Zool.; of 313 and 314 from Nova Teutonia, Santa Catarina, Brazil, 13 March, 1936, by F. Plaumann, in coll. Calvert; of fig. 315 from Alajuela, Costa Rica, Sept. 15, 1909, of 317 from Cartago, Costa Rica, May 15, 1909, no. 31, of 318 from Laguna Ochomogo, Costa Rica. Sept. 25, 1909, no. 36, of 321 and 322 from Peralta, Costa Rica, Aug. 9, 1909, by P. P. Calvert, in his coll. Figs. 308-310 from photographs by A. Delwyn Warden from figs. F, G and A, page 490, Ann. Mag. Nat. Hist. (10) 3, May, 1929; fig. 317 by P. P. Calvert.

Figs. 315, 317, 318, 321 and 322 are of *luteipennis florida* Hagen, 311-314, 316, 319 and 320 of *luteipennis luteipennis* Burmeister. See also fig. 72, pl. VI for *luteipennis luteipennis* Burm., upper surface of frons ♀.

PLATE XXV. *Maita* Foerster, *Aeshna* (*Rhionaeschna*) Figs. 323-327 and *manni* E. B. Williamson *Aeshna* (*Hesperaeschna*) Figs. 328-338

Fig. 323, head, thorax, base of abdomen, left wings and base of right wings of holotype male.

Figs. 324 and 325, left profile and dorsal views of apex of male abd.

Fig. 326, genitalia of second abdominal segment, ventral view, male, A right auricle.

Fig. 327, dorsal view of top of frons, male.

Figs. 328 and 329, left profile and dorsal views of apex of male abdomen of *Ae.* (*H.*) *manni*. In fig. 329 the right appendage is in dorsal view, the left in supero-internal view.

Fig. 330, dorsal view of top of frons, male.

Fig. 331, thoracic pattern, left side, male.

Fig. 332, second abdominal segment, ventral view, male.

Fig. 333, glans penis, ventral view.

Fig. 334, left profile view of ovipositor.

Fig. 335, ventral view of female abdominal appendages.

Fig. 336, second abdominal segment, left side, male.

Fig. 337, sixth abdominal segment, left side, male.

Fig. 338, left profile view of penis.

Original of figs. 323-327 from Arequipa, Peru, 2300 meters, 14 April, 1907, by K. Seyd, in Naturhist. Mus. Wiesbaden, male type of Foerster; of figs. 328-333, 336-338 from Palmarita water hole, Los Parres, Baja California, Mexico, October 8, 1923, by J. H. Williamson, with label "*Aeshna manni* paratype" in E. B. Williamson's handwriting; of figs. 334 and 335 from figs. 25 and 24, pl. iii, Occas. Papers Mus. Zool. Univ. Mich. 216: 19. Fig. 323 enlarged photograph by A. Delwyn Warden from photograph by Herr Kustos Christian Fetzner of the Wiesbaden Museum; figs. 324-327 by Dr. Erich Schmidt; 328-332, 337 by Leonard M. Pakman; 333 and 336 by P. P. Calvert, 333 under comp. microsc. Figs. 323-327 were furnished by Mr. John Cowley.

PLATE XXVI. *Marchali* Rambur, *Aeshna* (*Hesperaeschna*)

Figs. 339 and 340, left profile and dorsal views of apex of male abd.

Figs. 341 and 342, dorsal and right profile views of apex of male abdomen of holotype at Oxford Univ.

Figs. 343 and 346, dorsal views of top of frons, female and male.

Figs. 344 and 345, sixth abdominal segment, left side, male and female.

Figs. 347 and 348, first and second abdominal segments, left side, male and female. Unshaded areas pale blue (♂) or yellow (♀), shaded areas Van Dyke brown to black; the numerous long hairs are omitted from both figures.

Figs. 349-351, dorsal views of right superior appendages of three males.

Figs. 352, 356 and 357, thoracic patterns, left side, two males, one female, eleventh segment omitted from fig. 353.

Figs. 353 and 354, ventral and left profile views of apex of female abd.

Fig. 355, second abdominal segment, ventral view, male; A left auricle of another male showing three teeth.

Fig. 358, tip of penis, ventral view.

Fig. 359, left profile view of penis.

Originals of figs. 339, 340, 353, 354, 355 and 357 from Santa Fé de Bogota, Colombia, 339 from male no. 137, 340 and 355 from male no. 137a, 354 and 357 from female no. 137 from Dohrn, Mus. Comp. Zool.; 353 from female 1606, coll. Calvert; of 341 and 342 from Colombie, University Museum, Oxford, England; of 343, 344, 346, 347, 349-352, 356 from Quito, Ecuador, by F. Campos R., coll. Calvert, from males nos. 301, 303, 311, 312, 406, female no. 408; of 345 and 348 from vicinity of Limon, Dept. Cajamarca, Peru, 1900 meters, July 3, 1936, by Felix Woytkowski, Mus. Zool. Univ. Mich., no. 309; of 355A from Colombia by F. Ovalle Q., Amer. Mus. Nat. Hist.; of 358 and 359 from Guasuntos, Ecuador, by F. Campos R., coll. Calvert.

The original of fig. 352, Quito male no. 406, was selected as showing well the long pale lateral thoracic stripes; it has on the left mesepisternum an antehumeral pale green line, 1.8 mm. long, widest (.25 mm.) at its lower end, and also a subcircular yellow spot, .7 mm. in diameter, more than halfway between the antehumeral line and the mid-dorsal carina, from which latter it is .25 mm. distant; the *right* mesepisternum has no such antehumeral line but has a circular yellow spot, .57 mm. in diameter, halfway between the mid-dorsal carina and the right humeral suture and therefore not symmetrical with either line or spot of the left mesepisternum; this figure shows only the left antehumeral line, not the spot, which is too far over the convexity of the sclerite to be visible in this strictly profile view.

Figs. 341 and 342 enlarged by R. G. Schmieder from free-hand drawings by P. P. Calvert made at Oxford in 1895 or 1896; 343, 347, 348, 352 and 355A by P. P. Calvert.

PLATE XXVII. *Multicolor* Hagen, *Aeshna* (*Schizuraeschna*)

Figs. 360 and 361, left profile and dorsal views of apex of male abd.

Figs. 362 and 363, ventral and left profile views of apex of female abd.

Fig. 364, sixth abdominal segment, left side, male.

Fig. 365, oblique sinistro-ventral view of male genitalia.

al	anterior lamina	spr	spine of anterior lamina
gl	genital lobe	1-4	segments of penis
hf	hamular fold	} of anterior	1 also known as vesicle of the penis
hp	hamular process		
ph	posterior hamule		4 also known as glans penis
rm	right margin of genital fossa	IIsp	spiracle of second abdominal segment
sh	sheath of penis		

Fig. 366, thoracic pattern, left side, male.

Figs. 367, 370, 371, glans penis, ventral views; 367 dry, 370 and 371 after treatment by Borror's KOH and glycerine method, drawn in glycerine, 371 under Leitz comp. microsc., lower lens of objective removed.

Fig. 368, dorsal view of top of frons, male.

Fig. 369, left profile view of penis.

Fig. 372, second abdominal segment, ventral view, male.

Originals of figs. 360, 361, 364, 366-369 and 372 from Todos Santos, Baja California, Oct. 21, 1923, by J. H. Williamson, in coll. Calvert; of 362, 363 and 370 from Bates Pond, Wanita School, Sunnyside, Washington, July 14, 1912, by C. H. Kennedy, coll. Calvert ex coll. Williamson; of 365 and 371 from unknown locality, in alcohol, in A. N. S. P. Figs. 370 and 371 by P. P. Calvert.

PLATE XXVIII. *Peralta* Ris, *Aeshna* (*Hesperaeschna*)

All figures on Plates XXVIII and XXIX marked M are from males, nos. 3 and 4, from Matucana, Peru, May 26 and 27, 1920, by Jesse H. Williamson, in Mus. Zool. Univ. Mich.; marked Pu from males from Puno, Peru, Nov. 1 and 3, 1898, by Wm. J. Gerhard, in A. N. S. P.; marked Pe from a male, no. 205, from Penco, Chile, Jan., 1905, by Carlos E. Reed, in A. N. S. P.; figures M, Pu and Pe of each part are arranged in the geographical sequence of these three localities from north to south, Matucana being the most northern, Penco the most southern.

Figs. 373-375 and 376-378, left profile and dorsal views of apex of male abdomen.

Figs. 379-382, dorsal views of top of frons, three males, one female, as marked.

Figs. 383-385, second abdominal segment, ventral views, males.

PLATE XXIX. *Peralta* Ris, *Aeshna* (*Hesperaeschna*)

See note at beginning of explanation of Plate XXVIII.

Figs. 386-388, thoracic pattern, left side, males.

Fig. 389, first and second abdominal segments, left side, male; numerous long hairs of both segments omitted to show contours of segments clearly.

Figs. 390-392, sixth abdominal segment, left side, males.

Figs. 393-395, tip of penis, ventral view.

Figs. 396 and 397, ventral and left profile views of apex of female abd.

Figs. 398-400, left profile views of penis.

Originals of figs. 396 and 397 from Puno, Peru, 3800 meters, Staudinger vd., coll. Cowley, no. 1801, abdomen somewhat compressed. Fig. 389 by P. Calvert, 396 and 397 by Eleanor Bareiss.

PLATE XXX. *Perrensi* McLachlan, *Coryphaeschna*

Figs. 401, 402 and 403, 404, left profile and dorsal views of apex of abdomen, males.

Figs. 405, 409, glans penis, ventral views.

Figs. 406, 410, left profile views of penis.

Figs. 407, 408, second abdominal segments, ventral views, males.

Originals of figs. 401, 403, 405-407 from Sapucay, Paraguay, 12-2-03, by W. T. Foster in A. N. S. P.; of 402, 404, 408-410 from Balsapuerto, Peru, May, 1935, by G. G. Klug, in coll. Cowley, no. 1. Figs. 402, 404, 408 and 410 by Leonard M. Pakman, 405 and 409 by P. P. Calvert, under Leitz comp. microsc., with accompanying .1 mm. scale.

PLATE XXXI. *Psilus* Calvert, *Aeshna* (*Hesperaeschna*)

Figs. 411 and 412, left profile and dorsal views of apex of male abd.

Fig. 413, dorsal view of top of frons, male.

Figs. 414 and 418, thoracic pattern, left side, male and female.

Figs. 415 and 422, left profile and ventral views of apex of female abd.

Fig. 416, second abdominal segment, left side, male.

Fig. 417, sixth abdominal segment, left side, male.

Fig. 419, second abdominal segment, ventral view, male.

Fig. 420, glans penis, ventral view.

Fig. 421, left profile view of penis.

Fig. 423, dorsal view of left abdominal appendage, female, for comparison with fig. 119, plate IX, of *cornigera cornigera*.

Originals of figs. 411, 412 and 419 from Cachi, Costa Rica, March 10, 1910, stagnant pool, banks of Rio Reventazon, by P. P. Calvert, holotype male, in A. N. S. P., no. 9273; of 413, 414, 416 and 417 from road San José to La Verbena, Costa Rica, May 16, 1909, by P. P. Calvert, no. 308; of 415 and 422 from Guadalajara, Mexico, Sept. 11, 1903, by J. F. McClendon, nos. 31 and 353 in coll. Calvert; of 418 and 423 from El Volcan Chiriqui, Panama, 19.ii.1936, by F. E. Lutz, in A. M. N. H., no. 212; of 420 and 421 from region of Lake Chapala, Jalisco, Mexico, Dec. 5, 1923, by J. H. Williamson, in Mus. Zool. Univ. Mich., no. 325. Figs. 416, 418, 420 and 423 by P. P. Calvert, 420 under Leitz comp. microsc.; 421 by Eleanor Bareiss.

PLATE XXXII. *Punctata* Martin, *Aeshna* (*Hesperaeschna*)

Figs. 424-426, left profile views of apex of male abdomen.

Fig. 427, second abdominal segment, ventral view, male.

Figs. 428 and 429, dorsal views of top of frons, males.

Fig. 430, left half of anterior lamina and left hamular process, male.

Figs. 431-433, sixth abdominal segment, left side, males.

Figs. 434-436, dorsal views of apex of male abdomen.

Fig. 437, left profile view of penis.

Fig. 438, tip of penis, ventral view.

Figs. 439 and 440, thoracic patterns, left side, males.

Originals of figs. 424 and 434 from male L2 (*Aeschna lobata* Hagen MS.); of 425, 427, 428 and 435 from male L22 (*Ae. depravata* Hagen MS.), of 439 from male L21 (*Ae. depravata* Hagen MS.), all three from Nova Friburgo, Rio de Janeiro, Brazil, by Beschke, Mus. Comp. Zool., L21 to coll. Calvert; of 426, 429-431, 436-438 and 440 from Nova Teutonia, Santa Catarina, Brazil, 9 Jan. 1936, by F. Plaumann, coll. Calvert; of 432 from Espiritu Santa, Brazil, Martin's holotype, ex coll. Frühstorfer, in Mus. Nation. d'Hist. Nat. Paris; of 433 Martin's paratype in Mus. d'Hist. Nat. Brussels. Figs. 432 and 433 by Dr. Erich Schmidt. NF and NT alongside figures on this plate stand respectively for the localities Nova Friburgo and Nova Teutonia.

PLATE XXXIII. *Punctata* Martin, *Aeshna* (*Aeshna*) Figs. 441-444;
Rufipennis Kennedy, *Coryphaeschna* Figs. 445-453

Figs. 441 and 442, ventral and left profile views of apex of female abdomen; left half of ovipositor broken at about half-length; appendages slightly rotated so that they are not in plane view.

Fig. 443, plane dorsal view of right appendage of same female, separated from the body and under a cover glass.

Fig. 444, first and second abdominal segments, left side, male; unshaded areas blue, shaded areas black to burnt sienna (Smith's Glossary, pl. iv), the numerous hairs of both segments omitted.

Figs. 445 and 446, left profile and dorsal views of apex of male abdomen of *C. rufipennis*.

Fig. 447, glans penis, ventral view.

Fig. 448, left profile view of penis.

Fig. 449, thoracic pattern, left side, male.

Fig. 450, sixth abdominal segment, left side, male.

Figs. 451 and 453, ventral and left profile views of apex of female abdomen.

Fig. 452, dorsal view of top of frons, male.

Originals of figs. 441-444 from Nova Teutonia, Santa Catarina, Brazil, by F. Plaumann in coll. Calvert, 441-443 female Dec. 15, 1934, 444 male 9 Jan. 1936; of 445-453 from Satipo, Junin, Peru, 1940, by Pedro Paprzycki in coll. Kennedy, 445, 446 and 452 from male no. 2, Dec. 27, 447-450 from male no. 9, June 9, 451 and 453 from female May 23. Figs. 443-447, 449 and 452 by P. P. Calvert, 447 under Leitz comp. microsc.; 448 by Eleanor Bareiss, 450 by Leonard M. Pakman; 451 and 453 enlarged by P. P. Calvert from Kennedy, 1944, Ann. Ent. Soc. Amer. xxxii: 373, figs. 5, 4.

PLATE XXXIV. *Rufipes* Ris, *Aeshna* (*Aeshna*) Figs. 454-455;
Secreta Calvert 1952, *Coryphaeschna* Figs. 456-462; *Unicolor*
 Martin, *Aeshna* (*Aeshna*) Figs. 463-466

- Figs. 454 and 455, ventral and left profile views of apex of female abd.
 Fig. 456, first and second abdominal segments, ventral view, male, of *C. secreta*.
 Fig. 456A, detail of genitalia with margins of genital fossa spread more widely
 apart to show spines of anterior lamina; same scale as fig. 456.
 Fig. 457, dorsal view of apex of male abdomen.
 Fig. 458, dorsal view of top of frons, male.
 Fig. 459, sixth abdominal segment, left side, male.
 Fig. 460, thoracic pattern, left side, male.
 Fig. 461, glans penis, ventral view.
 Fig. 462, left profile view of penis.
 Fig. 463, dorsal view of top of frons, male, of *Ae. unicolor*.
 Fig. 464, sixth abdominal segment, left side, male.
 Figs. 465 and 466, dorsal and right profile views of apex of male abd.

Originals of figs. 454 and 455 from La Merced, Chanchamayo, Peru, by Dr. P. Martin, in coll. Cowley, female no. 3986, det. Cowley; of 456-462 from San Diego d. 1. Baños, Cuba, April 14.00, by Palmer & Riley, holotype male in U. S. N. M.; of 463-466 Bolivie, male lectotype of Martin in Mus. Nation. d'Hist. Nat. Paris. See also fig. 603, pl. XLVI. Figs. 454 and 455 by Eleanor Bareiss, 456, 457-460 and 462 by Leonard M. Pakman, 456A and 461 by P. P. Calvert, 461 under Leitz comp. microsc., 463 and 464 by Dr. Erich Schmidt, 465 and 466 from photographs by A. Delwyn Warden of Martin, 1908 Cat. Colls. Zool. Selys-Longchamps, fasc. xviii:55, fig. 52.

PLATE XXXV. *Variegata* Fabricius, *Aeshna* (*Hesperaeschna*)

- Fig. 467, male.
 Figs. 468 and 471, right-ventral and left profile views of apex of female abdomen.
 Figs. 469 and 470, left profile and dorsal views of apex of male abd.
 Fig. 472, left profile view of penis.
 Fig. 473, tip of penis, ventral view.
 Fig. 474, dorsal view of top of frons, male.
 Fig. 475, sixth abdominal segment, left side, male; unshaded areas pale blue, shaded areas from black to brown pink (Smith's Glossary, pl. iv).
 Fig. 476, thoracic pattern, left side, male.
 Fig. 477, second abdominal segment, ventral view, male.

Originals of figs. 467, 469, 470, 472-474 and 477 from Island Harbor, Patagonia, Acc. 21,699 U[nited] S[tates] F[ish] C[ommission], two males in U. S. N. M., nos. 129 (fig. 467) and 128 (the other figures listed); of 468 and 471 from Quebrada El Cheeso, Taltal, Chile, 11 Enero, 1942, Javar, female, and

of 475 and 476 from Angol, Chile, 18 Jan., 1942, by D. S. Bullock, male, both in coll. Needham. Figs. 467 photograph by A. Delwyn Warden, 468, 471 and 476 by Eleanor Bareiss.

PLATE XXXVI. *Vigintipunctata* Ris, *Aeshna* (*Marmoraeschna*)

Figs. 478, 479, 483-487, *Intricata* Martin, *Aeshna*
(*Marmaraeschna*), Figs. 480-482

Figs. 478 and 479, left profile and dorsal views of apex of male abd.
Figs. 480-482, two ventral and one left profile view of apex of female abdomen.
Figs. 483 and 484, left profile and dorsal views of apex of male abd.
Fig. 485, second abdominal segment, ventral view, male.
Fig. 486, tip of penis, ventral view.
Fig. 487, left profile view of penis and of ventral margin of second abdominal segment.

Originals of figs. 478, 479, 485-487 from Cordova, Argentina, in Mus. Comp. Zool. (*Aeschna laticeps* Hagen MS.); of 480 from vicinity of Chachapoyas, Dept. Amazonas, Peru, 2000 meters, Ago 8, 1936, by Felix Woytkowski, in Mus. Zool. Univ. Mich.; of 481 and 482 from vicinity of Celendin, Dept. Cajamarca, Peru, 2625 meters, June 10, 1936, same collector and museum; of 483 and 484 nine miles northeast of Coroico, Las Yungas, Bolivia, May 23, 1899, by Wm. J. Gerhard in coll. A. N. S. P. The abbreviations Chacha, Celen, Cord and Coro alongside some of the figures on plates XXXVI and XXXVII stand for the localities Chachapoyas, Celendin, Cordova and Coroico respectively.

PLATE XXXVII. *Vigintipunctata* Ris, *Aeshna* (*Marmoraeschna*)

Figs. 488-489, 491-493 *A. (M.) intricata* Figs. 490, 494-499,
Viriditas Calvert 1952, *Coryphaeschna* Figs. 500-504
and *Adnexa* Hagen *Coryphaeschna* Fig. 505

Figs. 488, 492 and 496, dorsal views of top of frons, two males, one female.
Figs. 489 and 490, thoracic pattern, left side, male and female.
Fig. 491, left wings, male.
Figs. 493-495 and 498, 499, first and second (in 499 only the second) abdominal segments, left side, three males, two females.
Fig. 497, sixth abdominal segment, left side, female.
Figs. 500 and 501, glans penis, ventral and left profile views.
Figs. 502 and 503, first and second abdominal segments, left side, female and male. These figures will serve for *C. adnexa* also.
Fig. 504, left profile view of penis.
Fig. 505, glans penis, left profile view.

Originals of figs. 488 and 491 (*vigintipunctata*) from Cordova, Argentina, in Mus. Comp. Zool. (*Aeschna laticeps* Hagen MS.); of 489 and 492 from nine miles northeast of Coroico, Las Yungas, Bolivia, May 23, 1899, by William J. Gerhard in coll. A. N. S. P., male; of 490, 495 and 498 (*intricata*) from

Chachapoyas, Dept. Amazonas, Peru, 2000 meters, by Felix Woytkowski, Ago. 8, 1936, female no. 16 (490, 498), Ago. 24, 1936, male no. 29 (495), both in Mus. Zool. Univ. Mich.; of 493 from Prov. Chapare, Dept. Cochabamba, Bolivia, 11.1930, male no. 23, coll. Kennedy; of 494, 496 and 497 (*intricata*) from vicinity of Celendin, Dept. Cajamarca, Peru, 2625 meters, by Felix Woytkowski, 494 male no. 26, May 29, 1936, 496, 497 female no. 17, June 10, 1936, in Mus. Zool. Univ. Mich.; of 499 (*intricata*) from La Merced, Chanchamayo, Peru, by Dr. P. Martin, female no. 31, det. Cowley, coll. Cowley; of 500, 501 and 504 from Guayaquil, Ecuador, by Prof. F. Campos R., no. 16 in coll. Calvert; 502 and 505 from Santiago de los Vegas, Habana, Cuba, by F. Z. Cervera, female 4 Dec., 1923, male, 17 July, 1924, in coll. Cowley; 503 from Rio Diria west of Santa Cruz, Costa Rica, Jan. 21, 1910, by P. P. Calvert, male no. 21 in coll. Calvert. Fig. 491 from photograph by Herman A. Walters, 493-495, 498-503, 505 by P. P. Calvert.

PLATE XXXVIII. *Viriditas* Calvert 1952, *Coryphaeschna* Figs. 506-512 and *Williamsoniana* Calvert, *Aeshna* (*Hesperaeschna*) Figs. 513 and 514

Figs. 506 and 509, left profile and dorsal views of apex of male abd.

Figs. 507 and 508, ventral and left profile views of apex of female abdomen; the length of one appendage in fig. 507 is 9.08 mm., its maximum flat width 1.04 mm. at about 3.85 mm. from base, whence it narrows gradually toward apex; this figure does not show the appendages flat but narrower than in nature, because of the partial rotation of the appendages in their natural position on the abdomen.

Fig. 510, second abdominal segment, ventral view, male.

Fig. 511, dorsal view of top of frons, female.

Fig. 512, sixth abdominal segment, left side, female.

Fig. 513, tip of penis, ventral view., of *Ae. (H.) williamsoniana*.

Fig. 514, left profile view of penis.

Originals of figs. 506, 509, 510 from Guayaquil, Ecuador, by Prof. F. Campos R., male no. 16, in coll. Calvert; of figs. 507, 508, 511 and 512 from Calabazar, Habana, Cuba, 23 Aug., 1923, by F. Z. Cervera, in coll. Cowley; of figs. 513 and 514 from Cuernavaca, Morelos, Mexico, July 8, 1900, by C. C. Deam, male holotype of Calvert, now in Mus. Zool. Univ. Mich. Figs. 513 and 514 by the late Grace Eager.

PLATE XXXIX. *Williamsoniana* Calvert, *Aeshna* (*Hesperaeschna*)

Fig. 515, dorsal view of top of frons, male.

Fig. 516, thoracic pattern, left side, male.

Figs. 517 and 518, sixth abdominal segments, left side, male and female.

Figs. 519 and 520, dorsal and left profile views of apex of male abdom.

Fig. 521, first and second abdominal segments, ventral view, male.

Fig. 522, dorsal view of top of frons, female.

Fig. 523, thoracic pattern, left side, female.

Figs. 524 and 525, left profile and ventral views of apex of female abd.

Originals of figs. 515-517, 519-521 from Cuernavaca, Morelos, Mexico, July 8, 1900, by Charles C. Deam, male holotype of Calvert; of figs. 518, 522-525 from Boquete, Chiriqui Mountains, Panama, March 28, 1923, by F. M. Gaige, female det. Leonora K. Gloyd, both in Mus. Zool. Univ. Mich. All figures on this plate by the late Grace Eager. Plate XXXIX and figs. 513 and 514 on Plate XXXVIII the gift of University of Michigan, Museum of Zoology by the then Director, Prof. F. M. Gaige. See also figs. 604 and 605, pl. XLVI.

PLATE XL. Larvae and Exuviae, Figs. 526-538

Figs. 526 *Luteipennis florida* (Hagen), *Coryphaeschna*, larva, female no. 17, 532, 537, exuviae, female no. 9, male no. 20.

Figs. 527-530, *Diffinis diffinis* Rambur, *Aeshna* (*Neureclipsa*), larvae, male, two females, male.

Fig. 531, *Psilus* Calvert, *Aeshna* (*Hesperaeschna*), exuvia, male.

Figs. 533, *Luteipennis luteipennis* Burmeister, *Coryphaeschna*, larva, male, 538, exuvia, male.

Fig. 534, Stem of sedge, *Eleocharis laevigata* (Tonduz det.) (Cyperaceae) showing egg-scars of *Coryphaeschna luteipennis florida* (Hagen); eggs laid October 8, 1909, hatched later, see Plate XLIII.

Fig. 535, *Viriditas* Calvert 1952, *Coryphaeschna*, larva, female.

Fig. 536, *Ingens* Rambur, *Coryphaeschna*, larva, male, no. 4.

Originals of figs. 526, 531 and 534 from Cartago, Costa Rica, 526 not dated, 531 Aug. 20, 1909, transformed Jan. 6-16, 1910, imago preserved, P. P. Calvert, in coll. Calvert; 527-529 near Malleco River, Angol, Chile, 1940 or 1941, 530 from Angol, Jan.-Feb., 1940, all four by D. S. Bullock in Coll. Needham; the venation very distinct in the hind wings of 530 making the specific determination certain; of 532 from Rio de las Cañas, north of Santa Cruz, Guanacaste, Costa Rica, June 30, 1910, by Tristán & Calvert, of 533 and 538 from Nova Teutonia, Santa Catarina, Brazil, March and 9.i., 1936, by Fritz Plaumann, all three in coll. Calvert; of 535 from Lagoa Tanaípe, Fortaleza, Ceará, Brazil, in coll. Needham; of 536 from Alachua County, Florida, Jan. 10, 1931, by Prof. C. F. Byers, no. 4, in coll. Calvert; of 537 from Agua Caliente, Guatemala, June 1, 1909, by E. B. Williamson in Mus. Zool. Univ. Mich. All figures on this plate from photographs by A. Delwyn Warden, the larvae under water.

PLATE XLI. *Psilus* Calvert, *Aeshna* (*Hesperaeschna*) Larvae, Figs. 539-554

Fig. 539, dorsal view of right procoxal process, male, penult exuvia.

Figs. 540 and 545, dorsal views of mentum and labial palps, male, 6ult and ultimate exuviae, respectively.

Figs. 541 ♂, 544 (penult), 548 (6-ult), 550 (5-ult), 551 (3-ult), and 552 (ult), dorsal views of middle of distal mental margin and (in 541 and 550 right labial palp also); fig. 548 shows also the adjoining posterior distal angle of the fixed hook of the right labial palp, the angle somewhat distorted from 90°.

Fig. 542, dorsal view of head, male, ultimate exuvia.

Figs. 543 (3-ult), 546 (6-ult), 547 (penult), 549 (5-ult), 553 (4-ult) and 554 (ult), dorsal views of apex of abdomen, male.

Originals of figures all obtained in rearing at Cartago, Costa Rica, by Amelia S. and P. P. Calvert, 1909-10, 6ult exuvia Aug. 22-23, 5ult Aug. 26-27, 4ult Sept. 13-17, 3ult Oct. 10-12, penult Nov. 10-12, ultimate Jan. 6-16, in coll. Calvert. Figs. 539-541, 544, 546, 548, 550-552 by P. P. Calvert, 540, 541, 544, 548, 550 and 552 under Leitz comp. microsc., lower lens of objective removed in 540, 541, 548 and 550; 542, 543, 545, 547, 549, 553 and 554 by Leonard M. Pakman.

PLATE XLII. *Diffinis* Rambur, *Aeshna* (*Neureclipsa*) Larva Figs. 555-561 and *Luteipennis florida* (Hagen), *Coryphaeschna* Larva Figs. 562-566

Fig. 555, dorsal view of mentum and labial palps; for ab see explanation of fig. 558.

Fig. 556, dorsal view of apex of male abdomen.

Fig. 557, entire larva, 9.43 mm. long, sex not yet differentiated externally, to show color pattern; larva turned a little toward the right, thus showing a little more than the right half of the dorsum and less than the left half.

Fig. 558, portion of lateral margin of the narrower proximal part of the mentum, on and near ab of fig. 555, showing granulations.

Fig. 559, ventral view of right labial palp, fixed joint (first segment) only, and more than the adjoining half of the distal mental margin.

Fig. 560, part of right hind wing rudiment, showing a portion of Cu2 and all of the anal and supplementary anal loops; shapes of the cells more accurately given than in fig. 561; x the same cell as in fig. 561; the anal loop has two vertical rows of cells; the supplementary anal loop has two horizontal rows of cells.

Fig. 561, right hind wing rudiment, enclosed in wing pad; object totally submerged in water; those areas left incomplete (empty) in the figure are not distinct in the insect; anterior side of triangle incomplete, no supratrangular cross-veins and only one anal cross-vein (anal crossing) evident, internal triangle not yet differentiated, no pigment in the pterostigma; vein rudiments with more pigment shown by slightly heavier lines (R1, M1, M2, posterior branch of Rs, Rspl, M3) or double lines (Sc, basal parts of R1 and M1); note that the anterior branch of Rs is less pigmented than the posterior branch; x, cell which I can not determine whether it will or will

not form part of the anal loop in the adult wing. The larva whose parts are shown in figs. 555, 556, 558, 560 and 561 is a male, total length 27 mm., head width 7.26 mm., front margin of hind wing pad 6.98 mm., venation of the last very distinct.

Figs. 562, 563 and 565, ventral views of ninth abdominal segment of *C. luteipennis florida*, females, showing development of the gonapophyses, 562 exuvia of Nov. 10-12, 1909, 563 exuvia of Dec. 12, 1909; 565 exuvia of Jan. 7-16, 1910, ovipositor (gonapophyses of 8th segment) turned to right side.

Fig. 564, ventral view of apex of abdomen, also showing the female gonapophyses, from an undated larva.

Fig. 566, right hind wing rudiment, enclosed in wing pad, object totally submerged in water; areas left blank in the figure are not distinct in the insect, no pigment in the pterostigma.

Originals of figs. 555, 556, 558, 560 and 561 from male larva, 557 and 559 from sexually undifferentiated larva, both from Angol, Chile, Jan.-Feb., 1940, by D. S. Bullock, in coll. Needham; of 562-566 from Cartago, Costa Rica, by A. S. and P. P. Calvert, in coll. Calvert. Figs. 555-561 and 566 by P. P. Calvert, 558 and 559 under Leitz comp. microsc., in 559 the lower lens of the objective removed; of 562-565 by Leonard M. Pakman.

PLATE XLIII. *Luteipennis florida* (Hagen), *Coryphaeschna*, Larvae,
Figs. 567-568

Fig. 567, larva of first instar from eggs laid in stem of *Eleocharis laevigata*, Cartago, Costa Rica, Oct. 8, 1909 (see fig. 534, pl. XL); hatched and passed first instar between Oct. 15 and 26; drawing made Oct. 27 from a larva which was alive and isolated Oct. 26 but dead when drawing was made.

Fig. 568, living larva of second instar from same eggs; sparsely spinulose on thoracic and anterior abdominal segments as indicated by dots in addition to the setae; drawing made Oct. 26. Both figures by P. P. Calvert.

PLATE XLIV. *Luteipennis florida* (Hagen), *Coryphaeschna*, Figs.
569-579, 581-586, and *l. luteipennis* Burmeister, fig. 587, Larvae;
580, gynacanthine larva

Fig. 569, dorsal view of head, exuvia, male.

Figs. 570-575, 577 and 583, dorsal views of mentum and one or both labial palps, 575 showing flexor and extensor muscles of palps; figs. 576, 579, 581, 582, 584-586, dorsal views of middle of distal mental margin and in 581, 582 and 584 parts of one or both labial palps; PF primary, and SF secondary, ligular fissures; they have been discussed for *Anax* by Calvert 1934, Proc. Amer. Phil. Soc. 73(1): 16.

Figs. 578 and 587, dorsal views of apex of male abdomens *l. florida* and *l. luteipennis* respectively.

Fig. 580, right labial palp of a gyncanthine female larva.

Originals of figs. 569 and 573 exuvia from Agua Caliente, Guatemala, shown in fig. 537, Pl. XL; of 570 and 576 exuvia of fourth instar, Jan. 7-16, 1910; larvae of 571 and 584 not dated, nos. 16 and 17; of 572 exuvia of Jan. 7-16, 1910, no. 10, female; of 574 and 579 larvae of first instar; of 575 and 582 larvae of second instar; of 577, 585 and 586 exuvia from Rio de los Caños, Costa Rica, Jan. 30, 1910, shown in fig. 532, Pl. XL; of 578 exuvia, male, Feb. 23, 1910; of 580 larva from Santa Marta, Colombia, Dec. 18, 1916, by E. B. Williamson, no. 192, female, in Mus. Zool. Univ. Mich.; of 581 and 583 exuvia of Feb. 11-12, 1910, sixth instar; of 587 male larva sc3 from Nova Teutonia, Santa Catarina, Brazil, March, 1936, by Fritz Plaumann, in coll. Calvert; localities not otherwise indicated from Cartago, Costa Rica, in coll. Calvert; all exuviae from Cartago from eggs laid Oct. 8, 1909. Figs. 569, 571-573 and 577 by Leonard M. Pakman, the others on this plate by P. P. Calvert, mostly (except 578, 580 and 587) under the comp. microsc.

Developmental sequence of the figures of the mentum on this plate: 574, 579, 575, 582, 570, 576, 583, 581, 572, 584, 573, 571, 577, 585, 586.

PLATE XLV. *Coryphaeschna* Larvae other than *luteipennis*,
Figs. 588-602

Figs. 588, 594-597, *Adnexa* Hagen. Dorsal views of right labial palp and right half of distal mental margin and apex of fixed hook enlarged (588 labium c), of middle of distal mental margin (594 labium c, PF omitted, 595 labium a, 596 labium b); dorsal view of apex of male abd. (597).

Figs. 589, 590 and 598, *Ingens* Rambur. Middle of distal mental margin and one labial palp (589 younger, sex not yet differentiated, 590 older, male); dorsal view of mentum and most of labial palps, ultimate exuvia, female (598).

Figs. 591, 592 and 599, *Viriditas* Calvert 1952. Dorsal view of head (591); ventral view of ninth abdominal segment, showing gonapophyses (592); dorsal view of mentum and labial palps (599), all from ultimate exuvia, female.

Figs. 593 and 602, *Perrensi*? McLachlan. Dorsal views of apex of male abdomen (593) and of mentum and labial palps (602), both from ultimate exuvia.

Figs. 600 and 601, species? Dorsal views of distal half or more of mentum and labial palps (600) and of middle of distal mental margin (601), both from ultimate exuvia, female.

Originals of figs. 588, 594-596 from microscopic slide lent by Prof. J. G. Needham, labeled "Tortugeiro lake 20.iii.35", Puerto Rico; 597 from same locality and date, coll. Calvert ex coll. Needham; 589 from Half Moon Lake, Alachua County, 2.9.1939, no. 10, 590 from Lake Miccosukee, Jefferson County 1.17.91, female, no. 12, both localities in Florida, coll. C. F. Byers; 598 from Cartaret Lodge Pond, Beaufort, North Carolina, June 30, 1934, by Prof. A. S.

Pearse, in coll. Calvert; of 591, 592 and 599 from Wismar, British Guiana, on reeds in flat above swamp, Feb. 15, 1912, by E. B. Williamson, in Mus. Zool. Univ. Mich., ultimate exuvia, female no. 6; of 593 and 602 from Barro Colorado Island, Canal Zone, Panama, ultimate exuvia, male, "taken from vegetation sticking from the water of a small rain pond about 100 feet above lake level (Gatun Lake) on the northwest part of the island, on July 22, 1950" by Robert B. Cumming, in coll. Univ. Florida; of 600 and 601 from Porto Velho, Brazil, "on under side green leaf 3' above little creek in woods 2½ Miles S. E." by J. H. Williamson, in Mus. Zool. Univ. Mich., ultimate exuvia, female, no. 8. Figs. 588-590, 593-598, 601-602 by P. P. Calvert, 588, 594-596 and 601 under Leitz comp. microsc. lower lens of objective removed except for 601; figs. 591, 592, 599 and 600 by Leonard M. Pakman.

PLATE XLVI. *Unicolor* René Martin, *Aeshna* (*Aeshna*) Fig. 603; *Williamsoniana* Calvert, *Aeshna* (*Hesperaeschna*) Figs. 604, 605

Fig. 603, male "lectotype sélectionné par Erich Schmidt le 22.vi.1951.," Bolivia, in Museum Nationale d'Histoire Naturelle, Paris. Photograph kindly furnished by Professor Lucien Chopard.

Figs. 604, 605, *Ae. (H.) williamsoniana* male holotype, Cuernavaca, Morelos, Mexico, in Univ. Mich. Mus. Zool., Ann Arbor. Photographs the gift of the Insect Division of the Museum. Both photographs show the wings of both sides folded over the back, the venation of the left wings distinctly, that of the right wings indistinctly here and there; fig. 604 especially for the venation; Fig. 605 shows some of the body coloration.

PLATE XLVII. *Luteipennis florida* (Hagen), *Coryphaeschna* Figs. 606, 608, 609, 611-613, *Viriditas*, *Coryphaeschna* Figs. 607, 610, 614

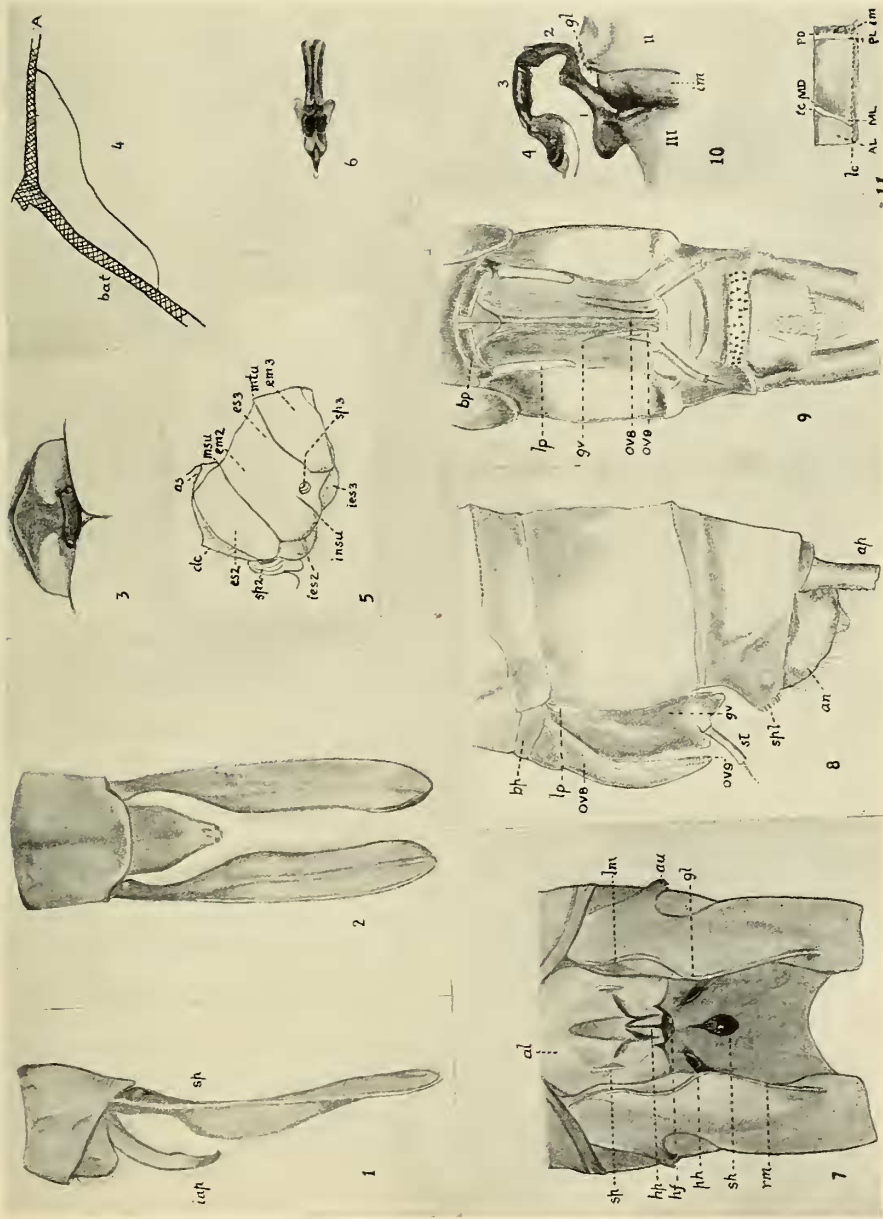
Figs. 606, 608, 609, 611-613 hind margin of head, dorsal view, 606 left half only, 611 right half only; 607, 610, 614 left labial palp and distal margin of mentum.

Originals of figs. 606, 608, 609, 611 and 612 from Cartago, Costa Rica; 606 Sult exuvia of Oct. 15-27, 1909, 608 ♂ larva killed Oct. 25-27, 609 Sult of Nov. 10-12, 611 Sult ♀ exuvia of Dec. 12, 612 Sult ♀ exuvia of Feb. 11-12, 613 Rio de las Cañas, Costa Rica, ♀ exuvia, Jan. 30, 1910, Tristán & Calvert; of 607, 610 and 614 Fortaleza, Ceara, Brazil. In these figures of the hind margin of the head no attempt has been made to show the spinules on the lateral margins but merely the shape of the outline. All figures by P. P. Calvert, under Zeiss (Grenfell) binocular, paired objectives ao (606, 608, 609, 611) or F55 (607, 610, 612, 613, 614).

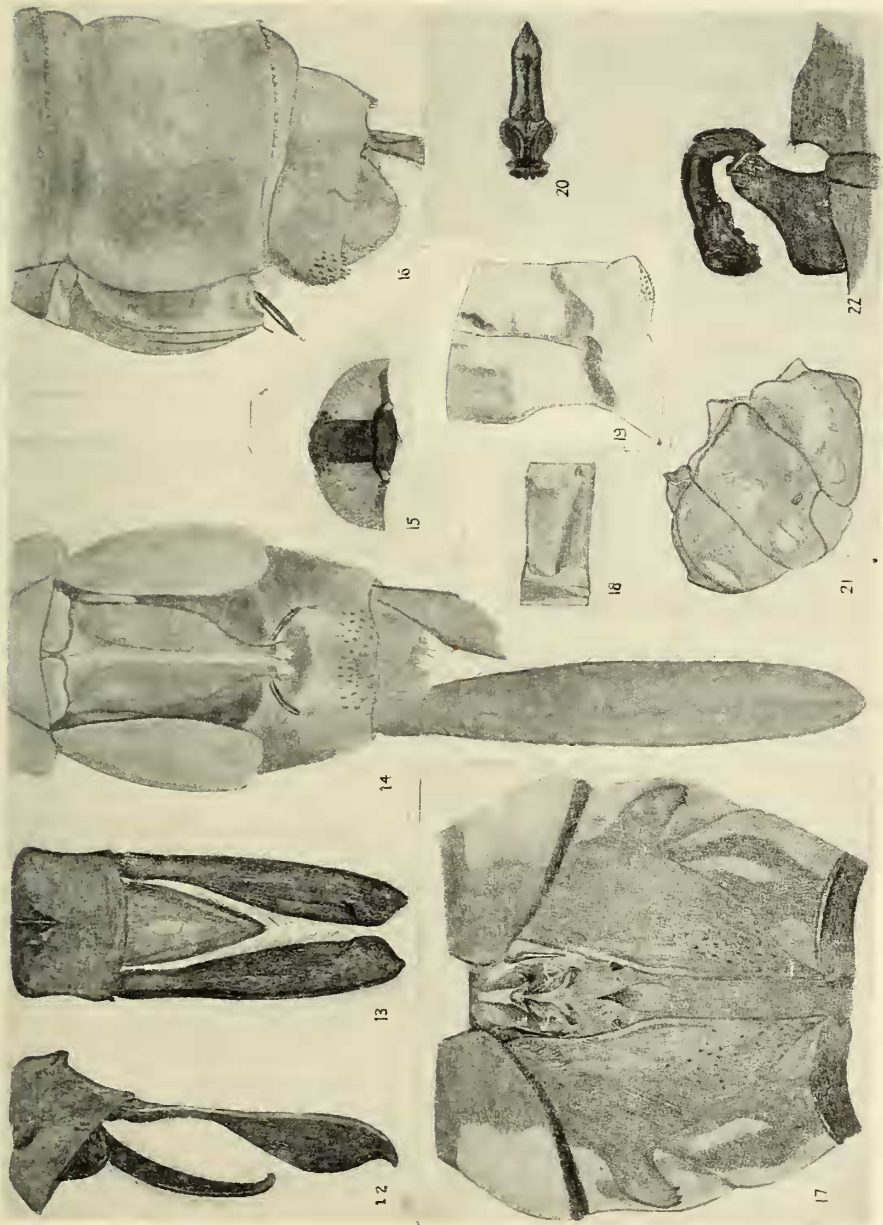
Reference: Calvert, P. P. 1952, New Taxonomic Entities in Neotropical Aeshnas (Odonata: Aeshnidae). Ent. News 63 (10): 253-264, Dec.

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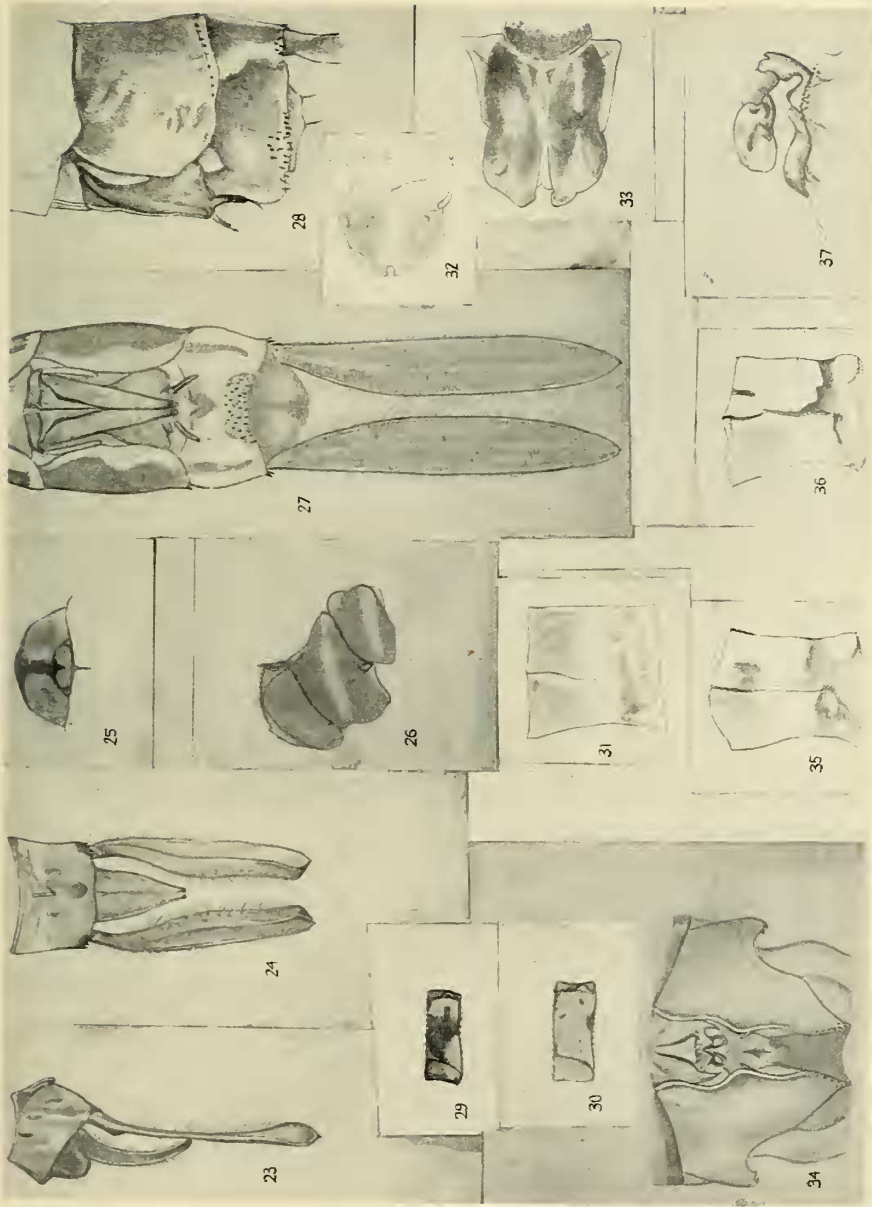
PLATES I-XLVII



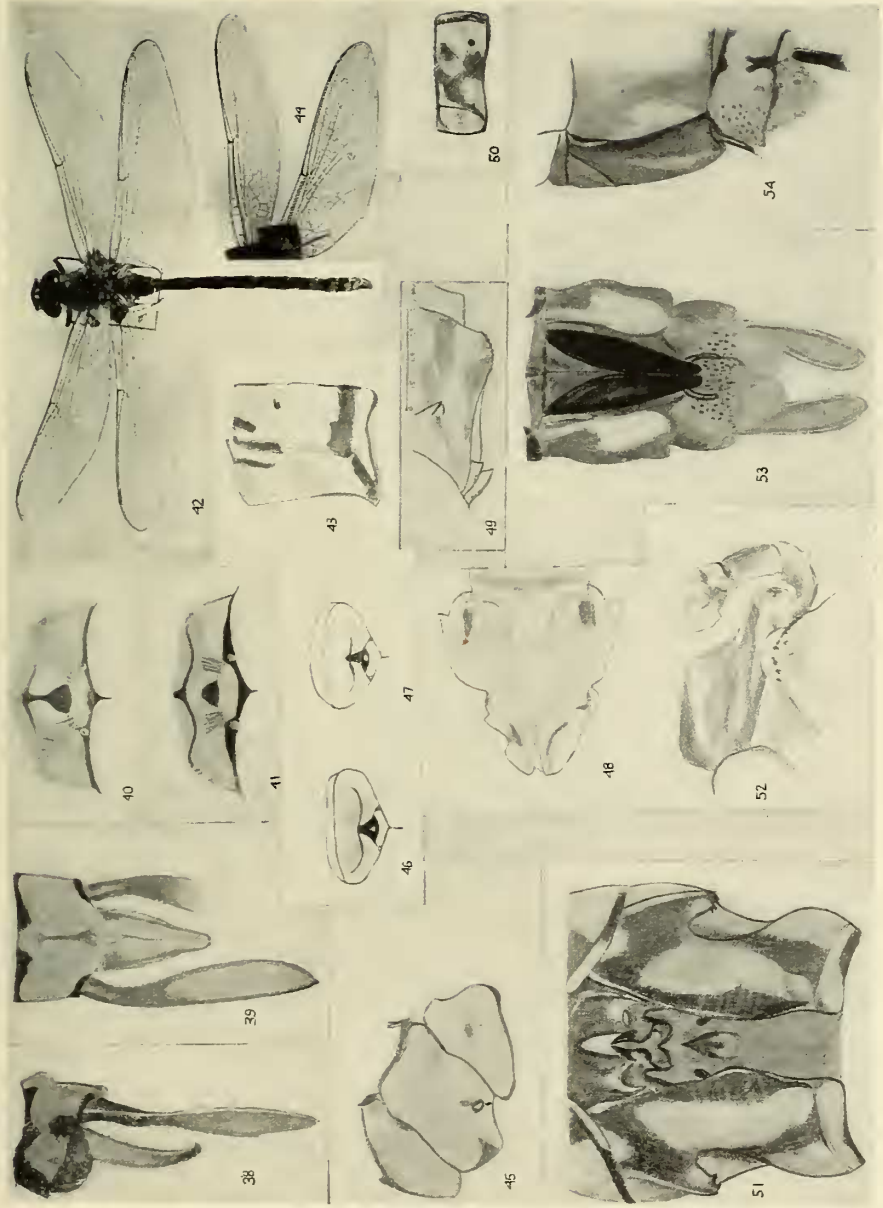
ADNEXA, CORYPHAESCHNA



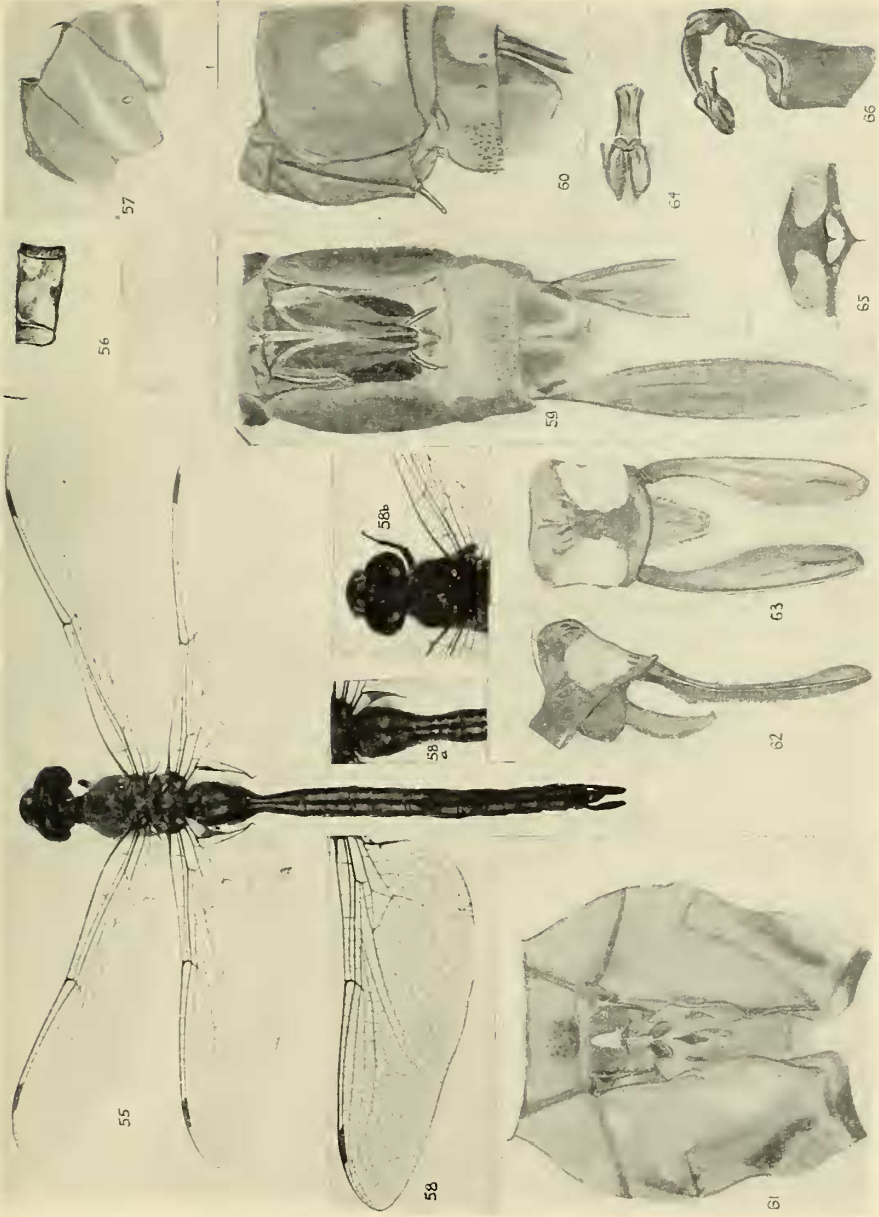
BILIOSA, AESHNA



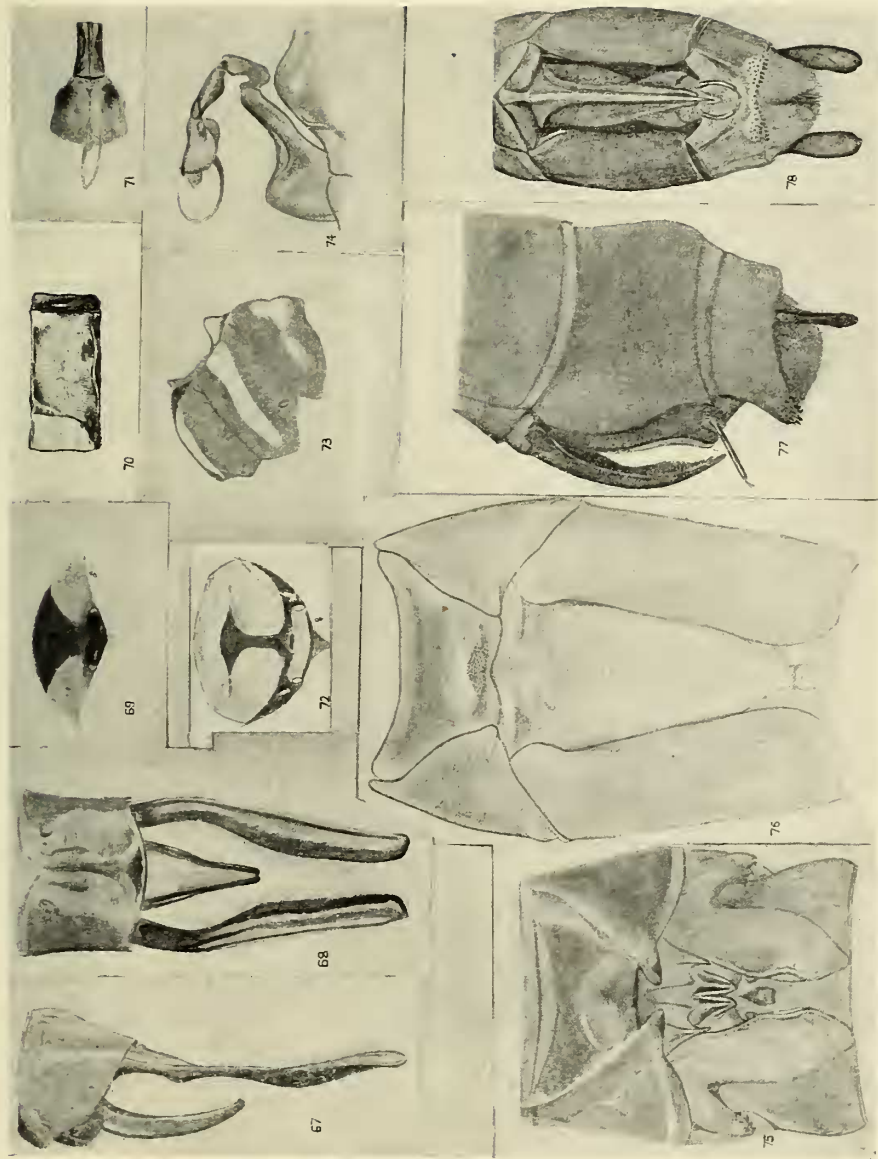
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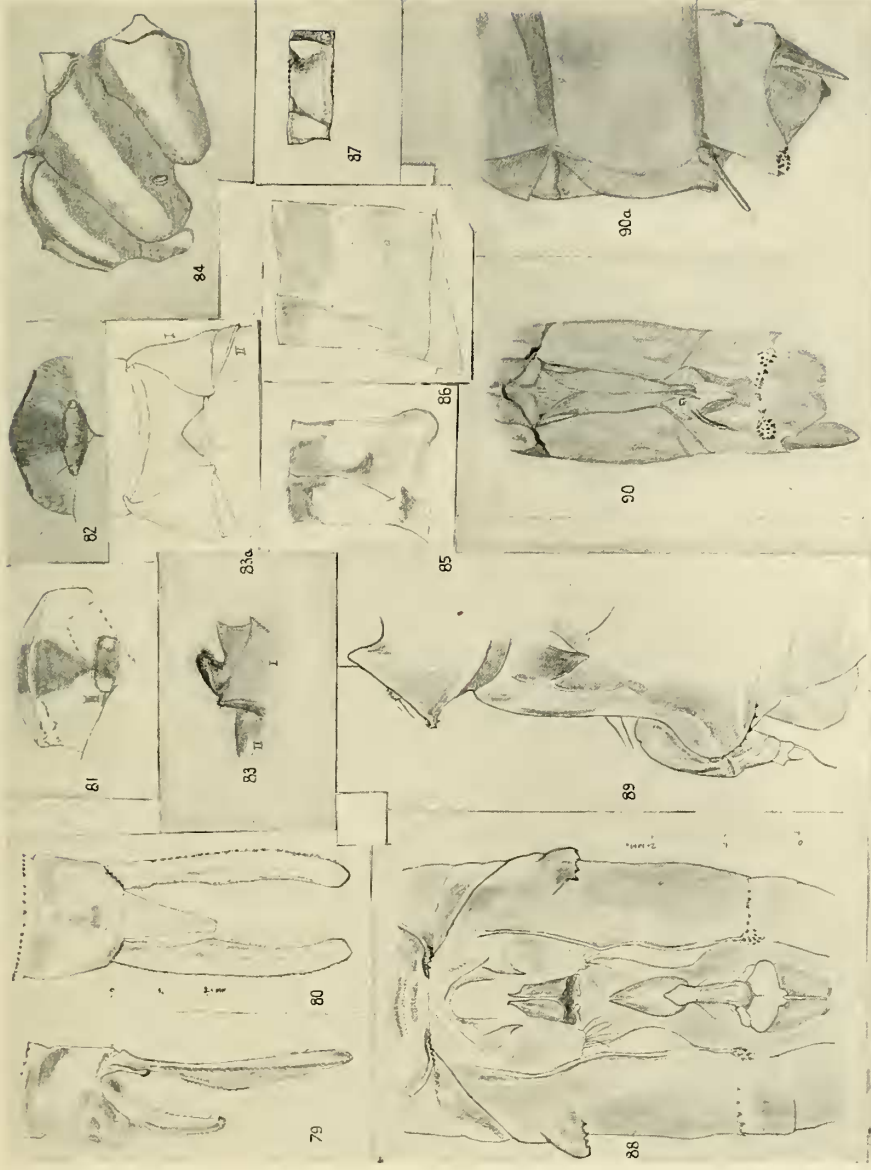
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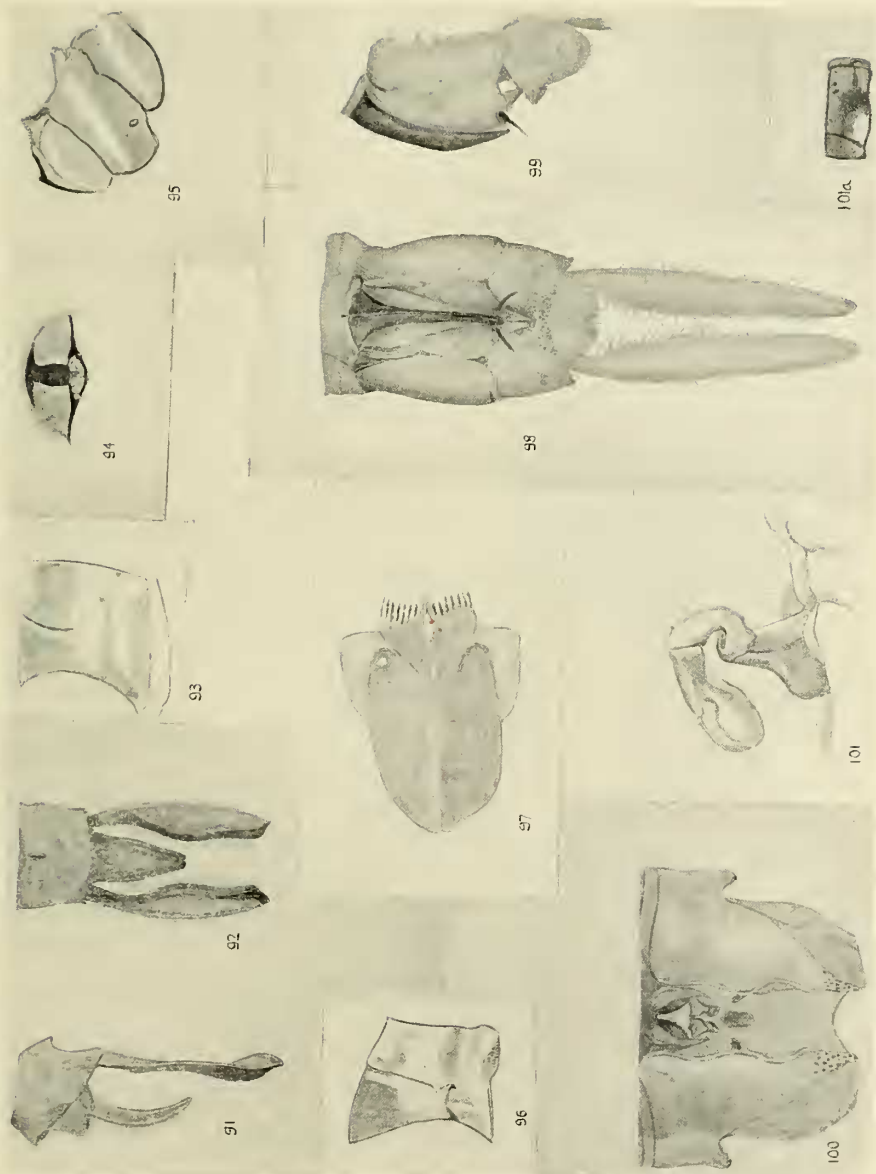
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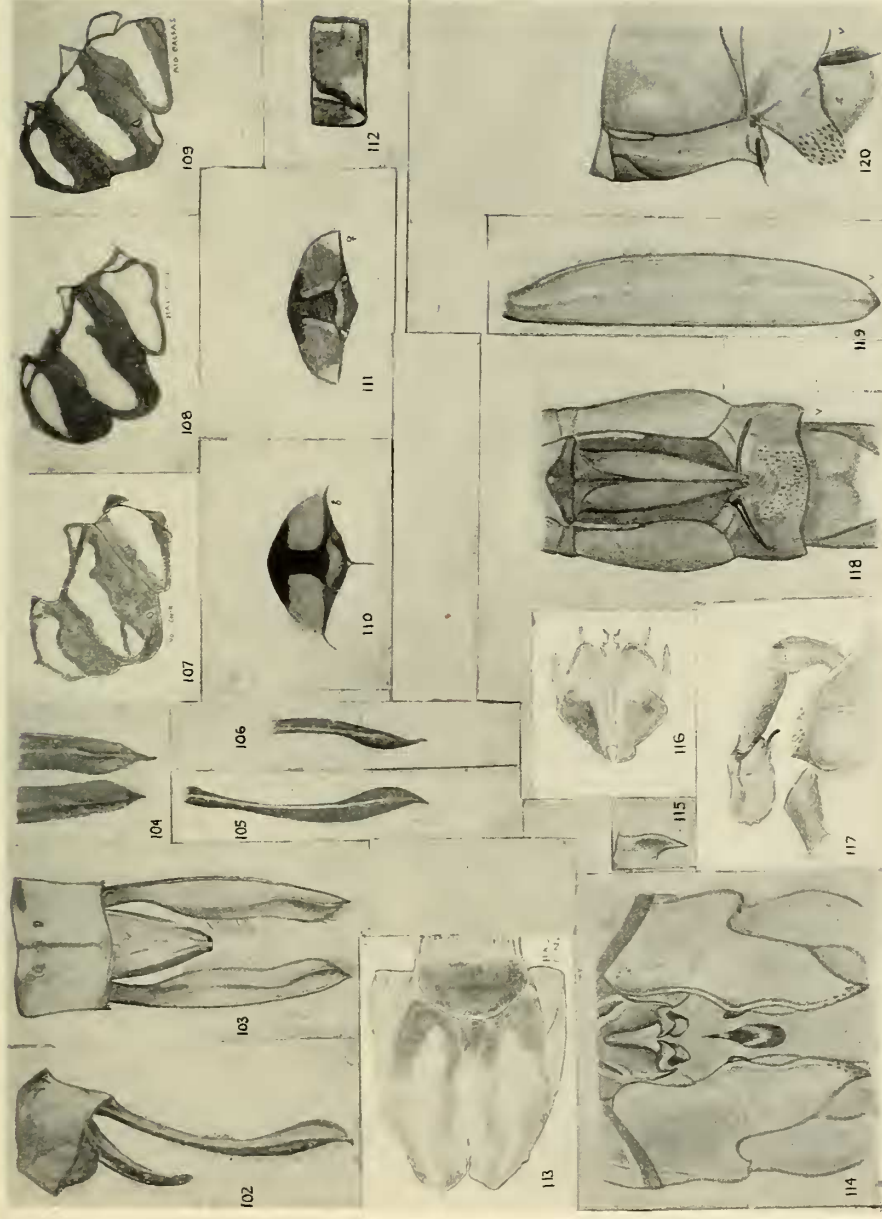
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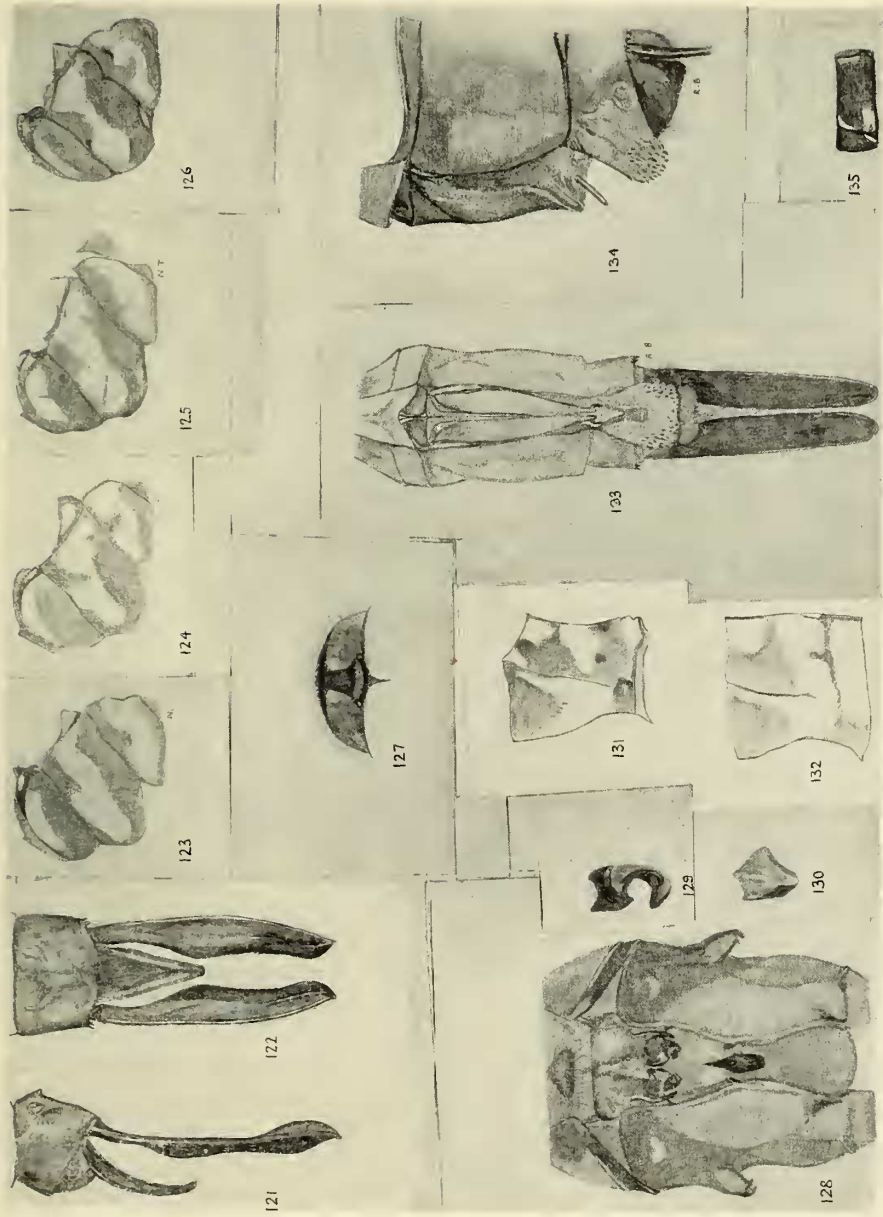
COLORATA, CASTORÆSCHNA



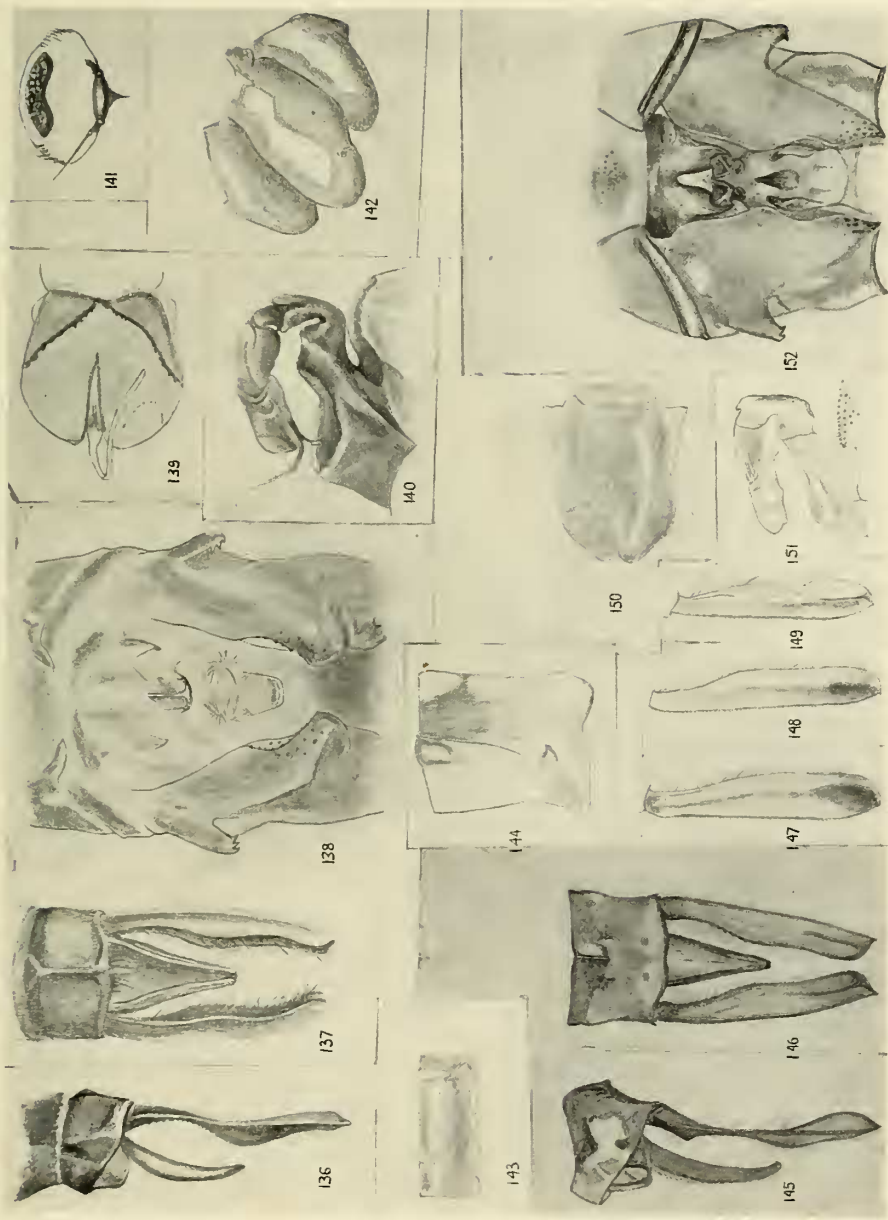
CONFUSA, HESPERAESCHNA



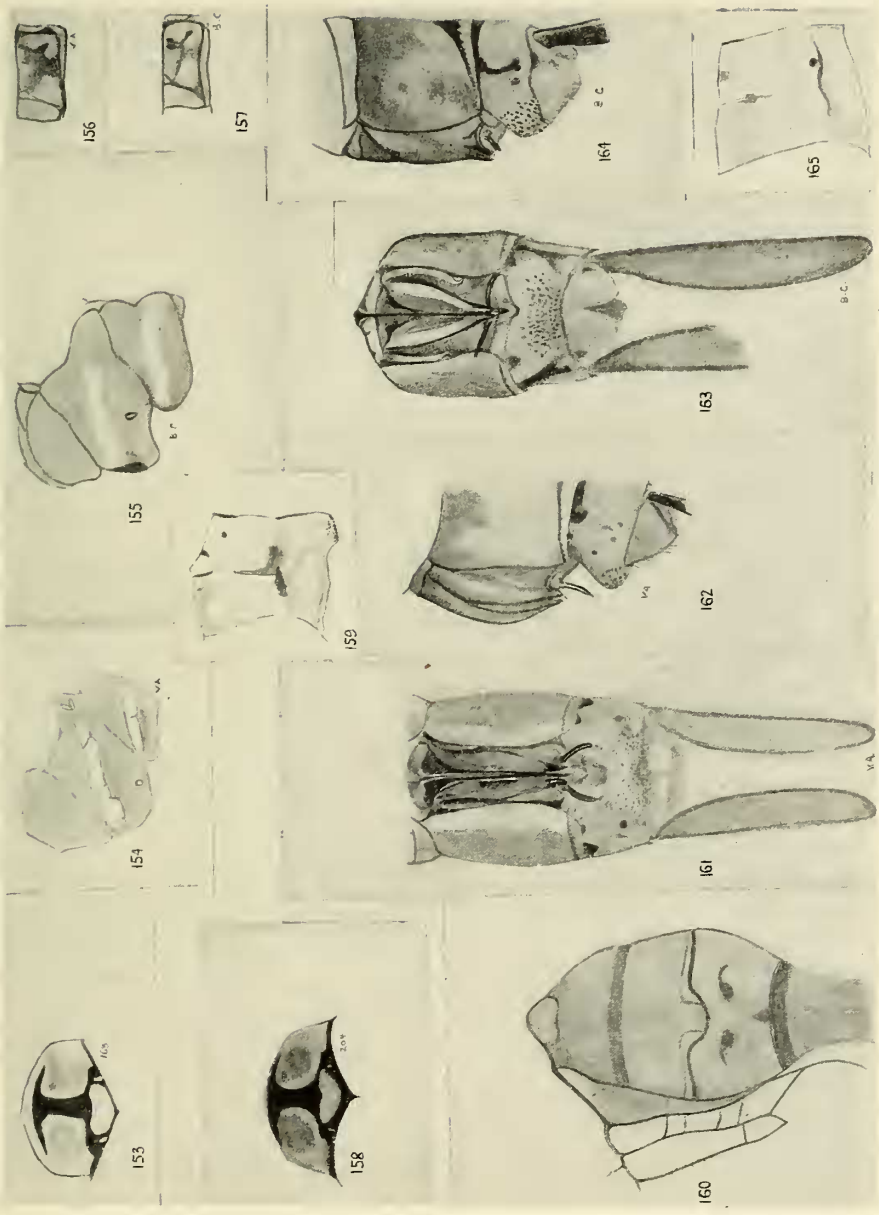
CORNIGERA CORNIGERA, HESPERAESCHNA



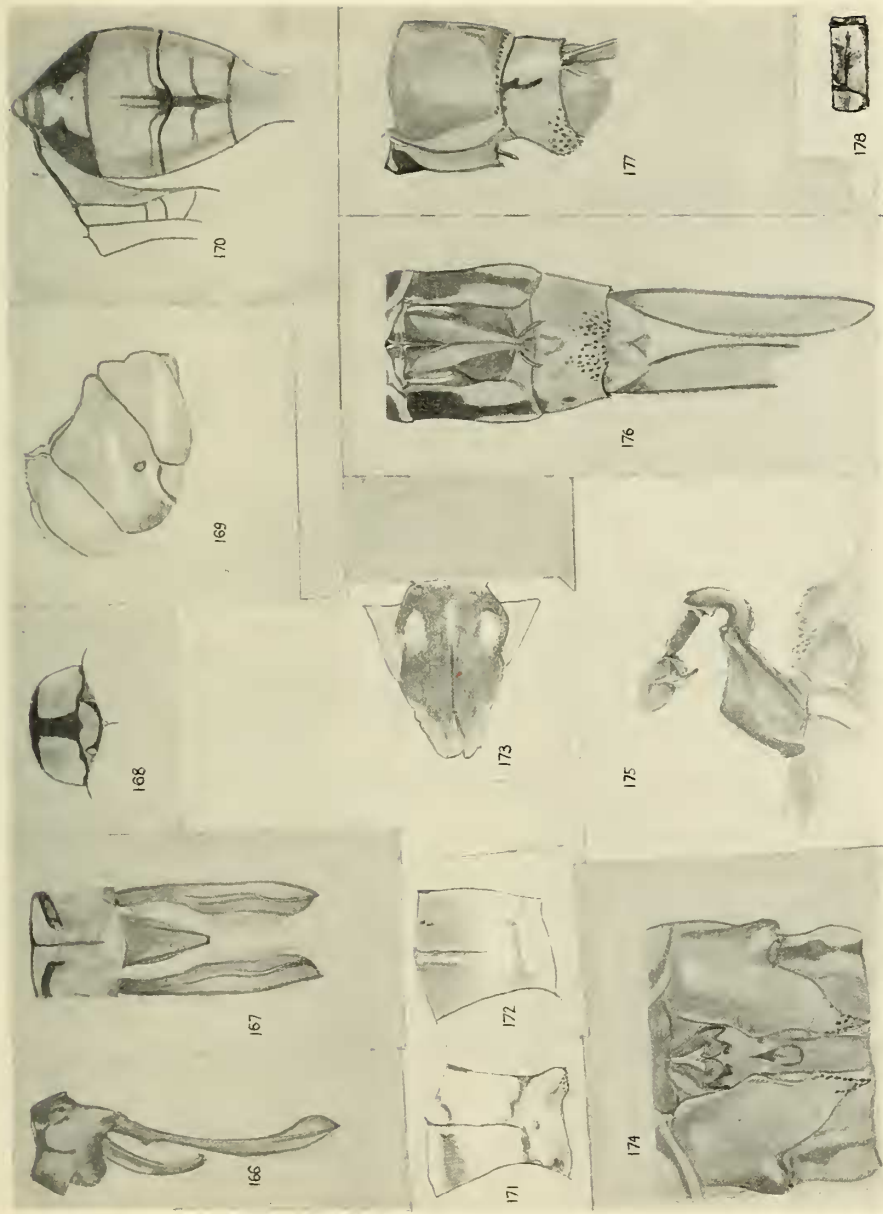
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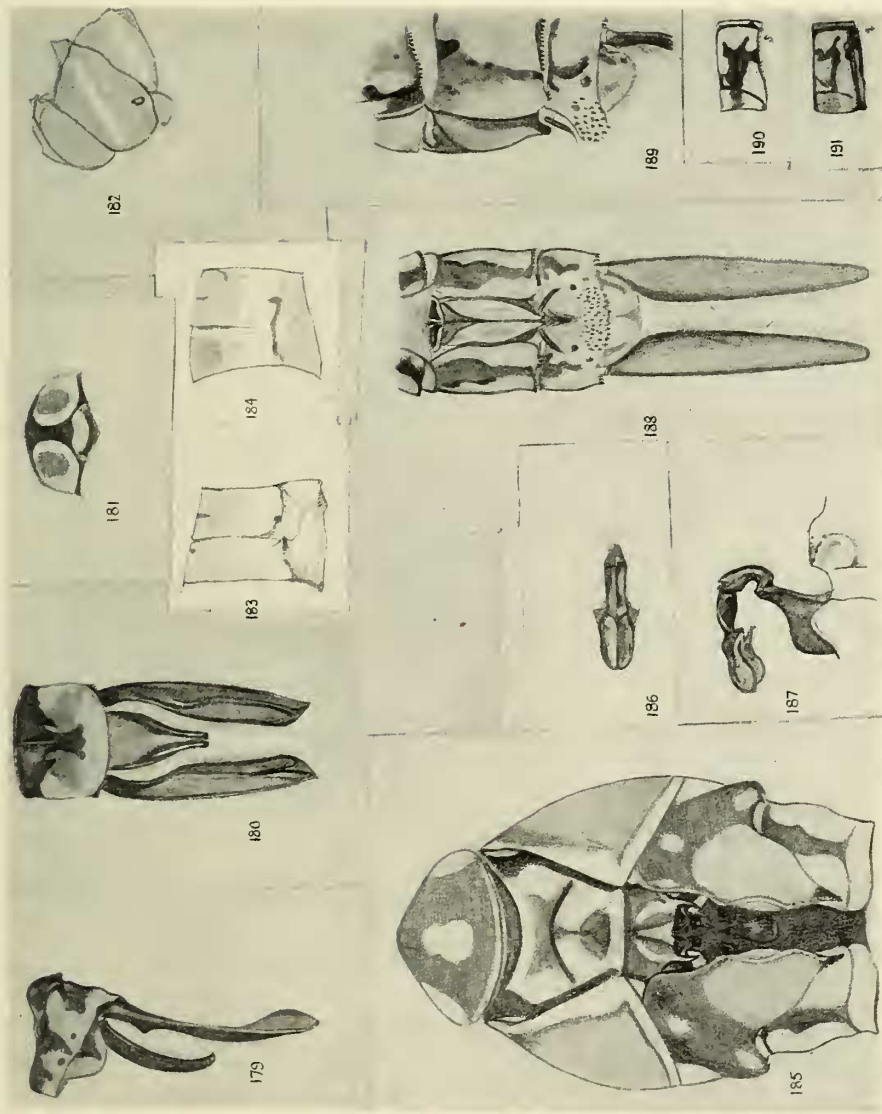
CORONATA, CASTORAESCHNA, 136-144, DIFFINIS DIFFINIS, NEURECLIPA 145-152



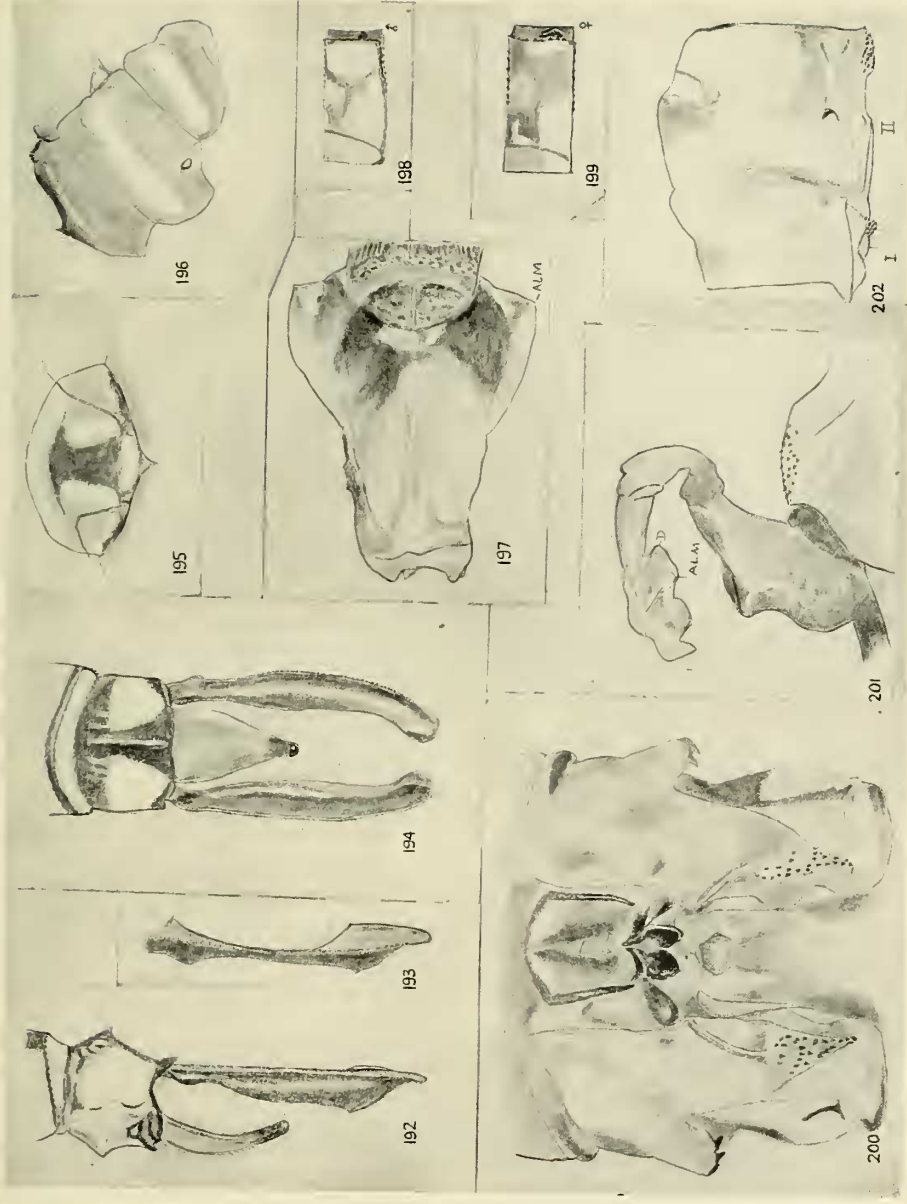
DIFFINIS DIFFINIS, NEURECLIPA



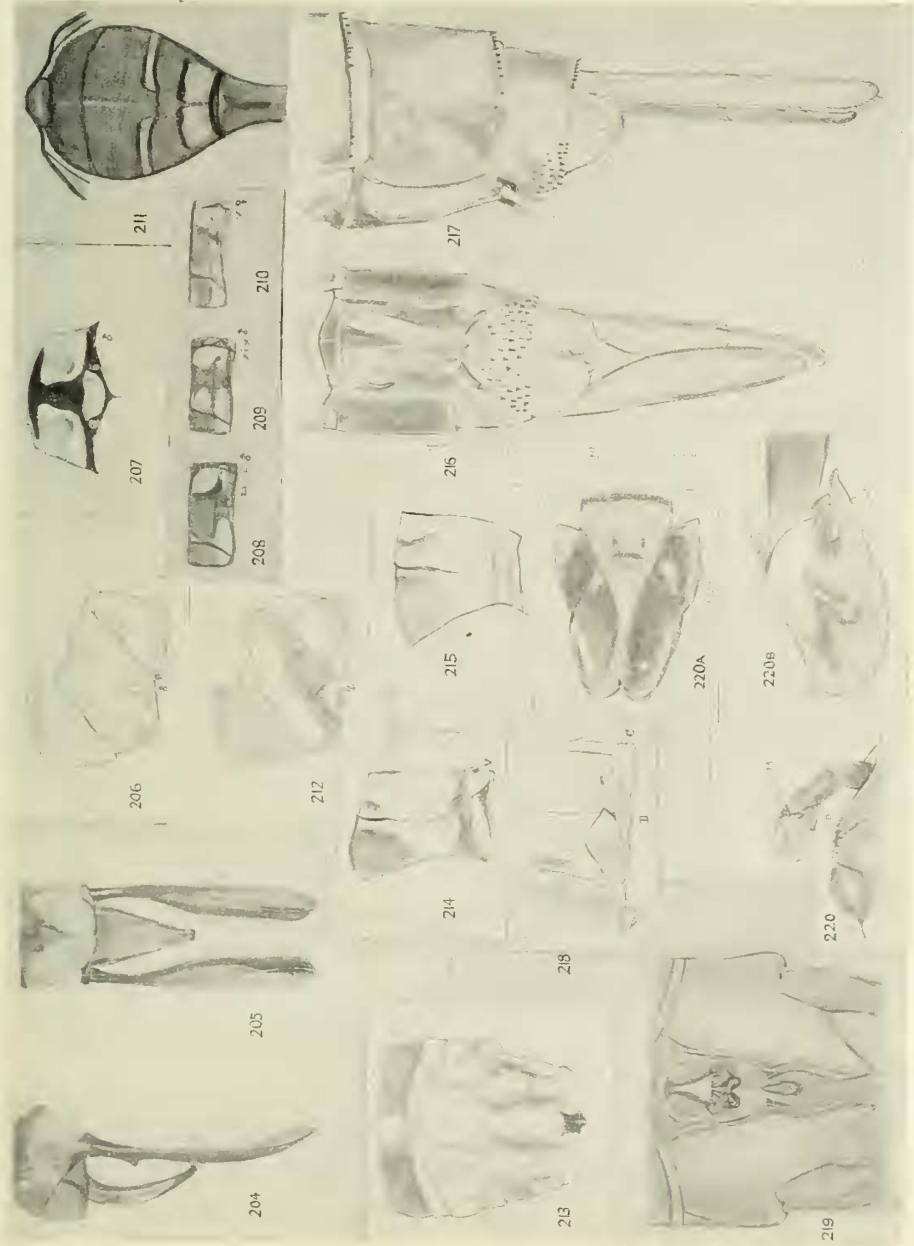
DIFFINIS DIFFINIS, NEURECLIPA



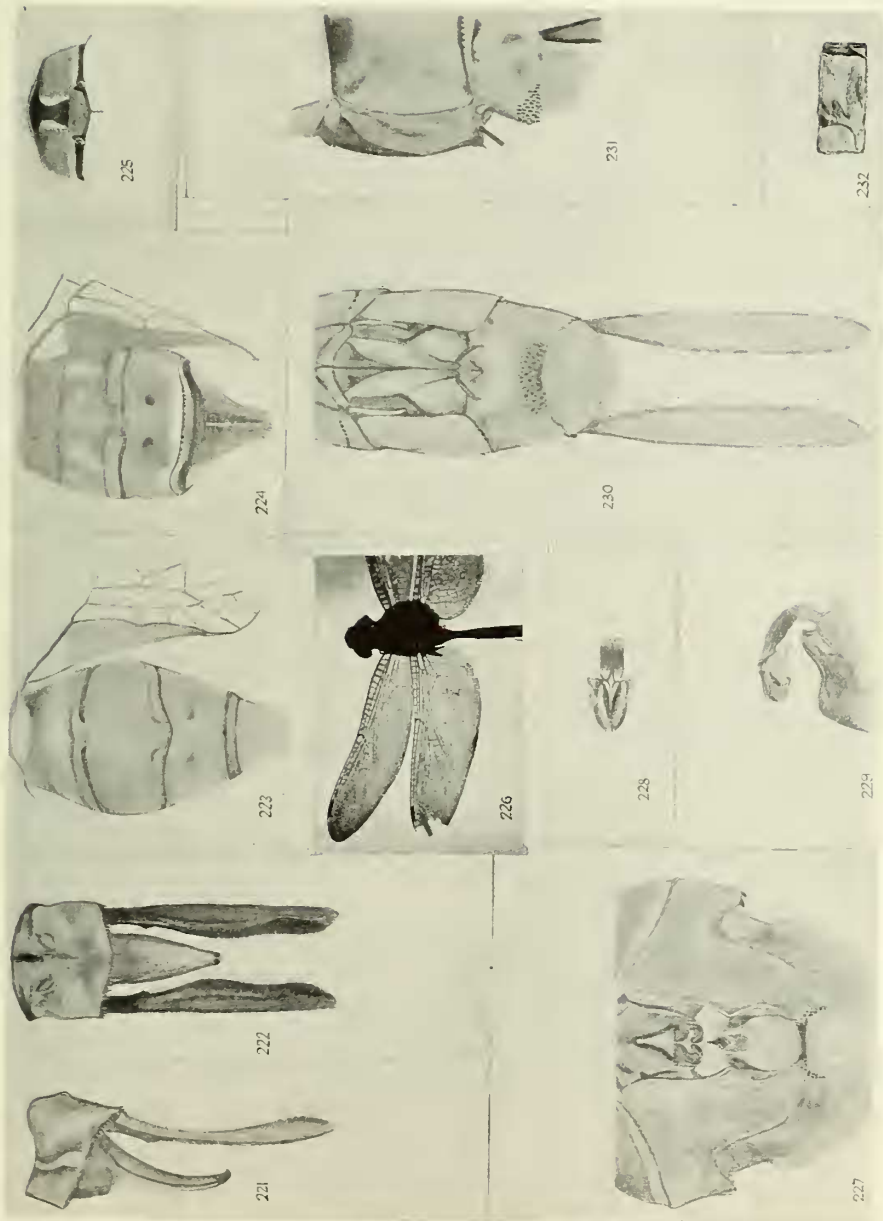
DIFFINIS ABSOLUTA, NEURECLIPA



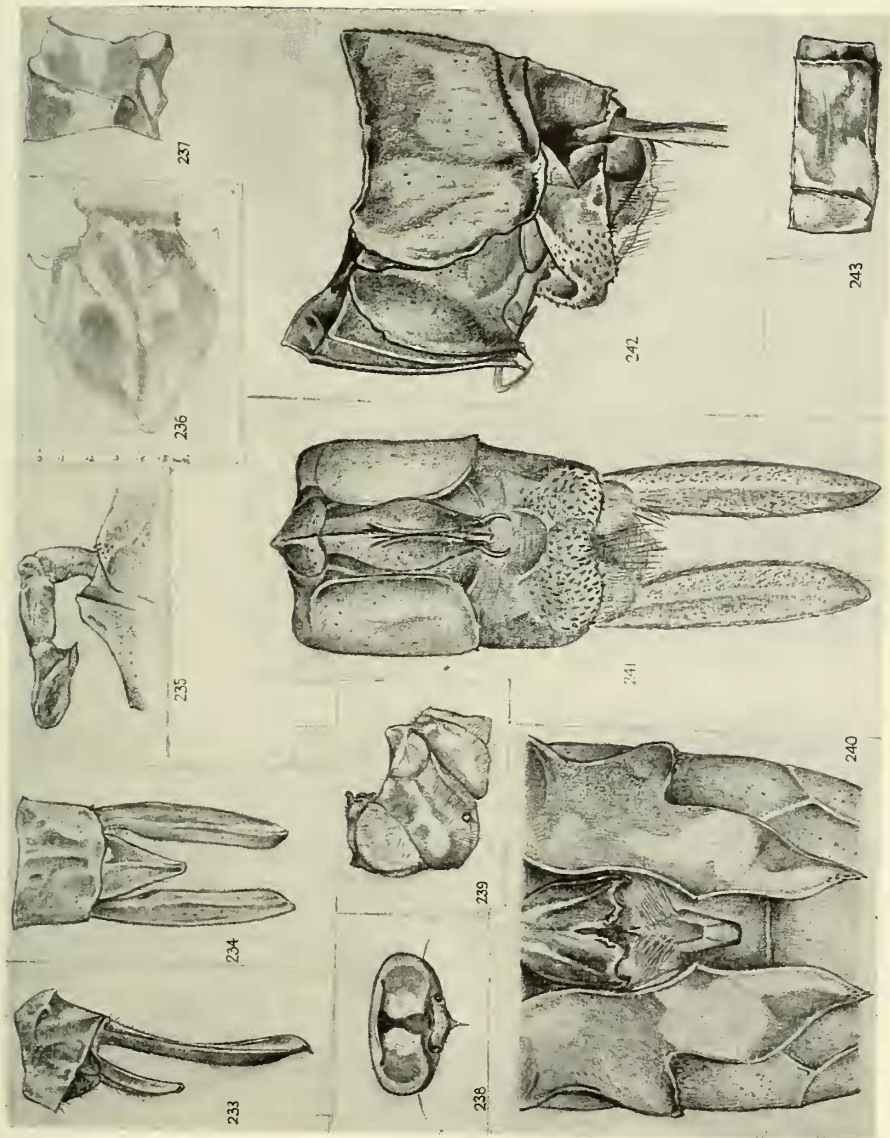
DUGESI, SCHIZURAESCHNA



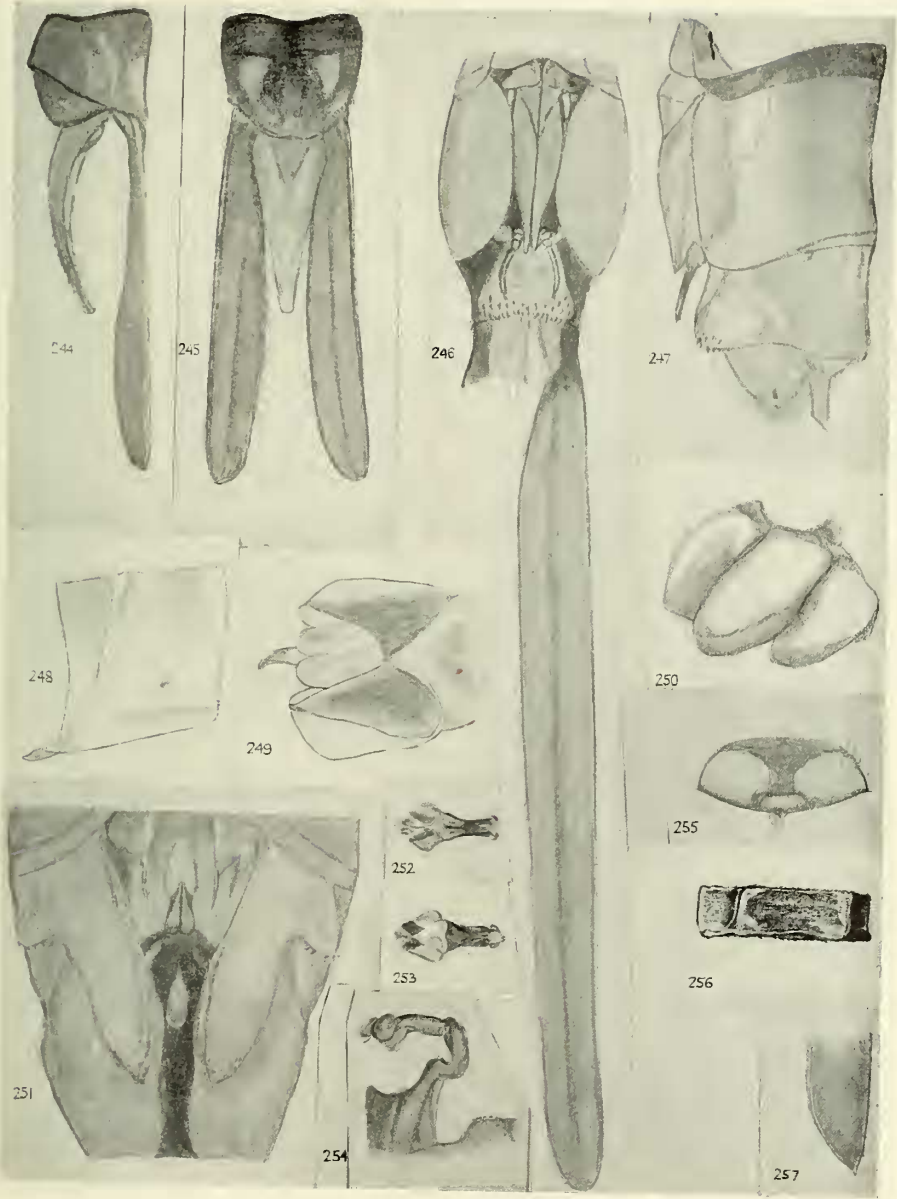
ELSIA, NEURECLIPA



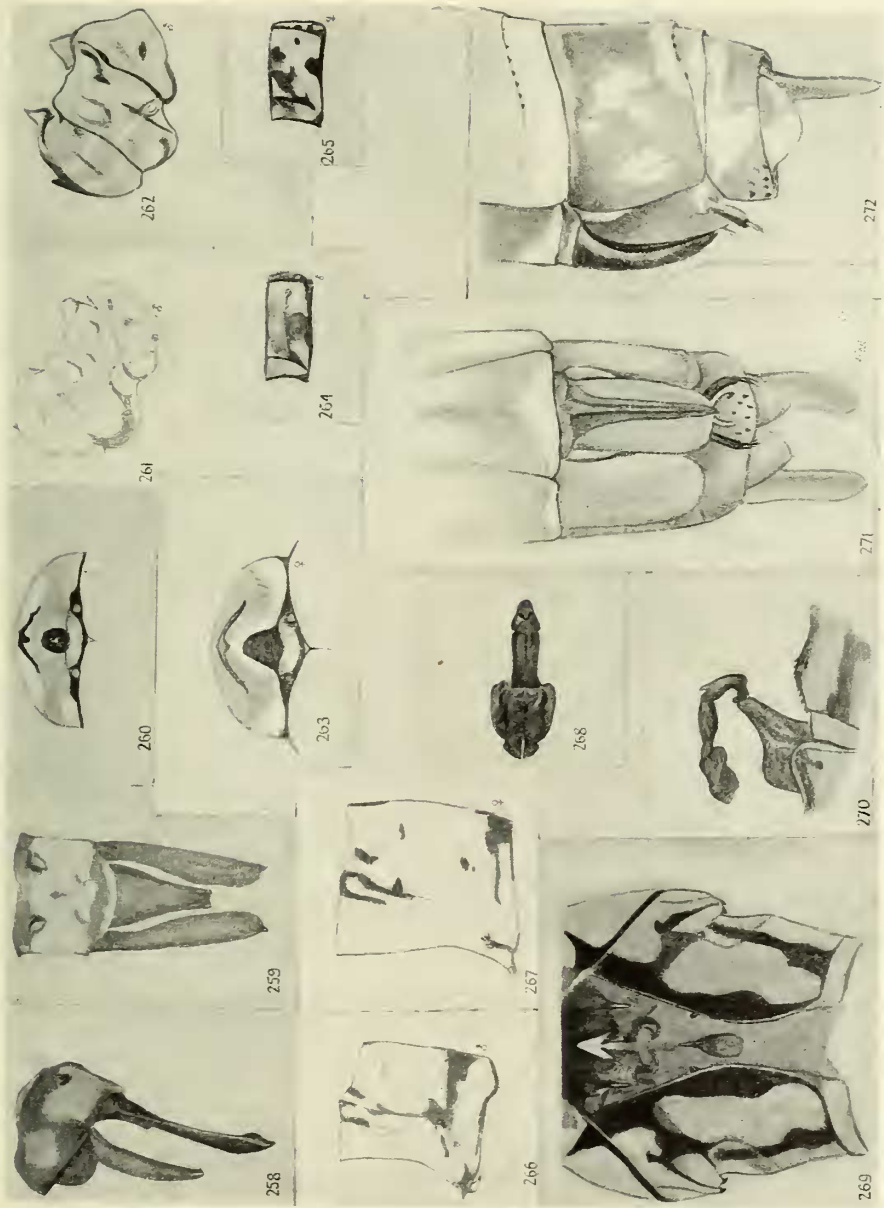
GALAPAGOENSIS, NEURECLIPA



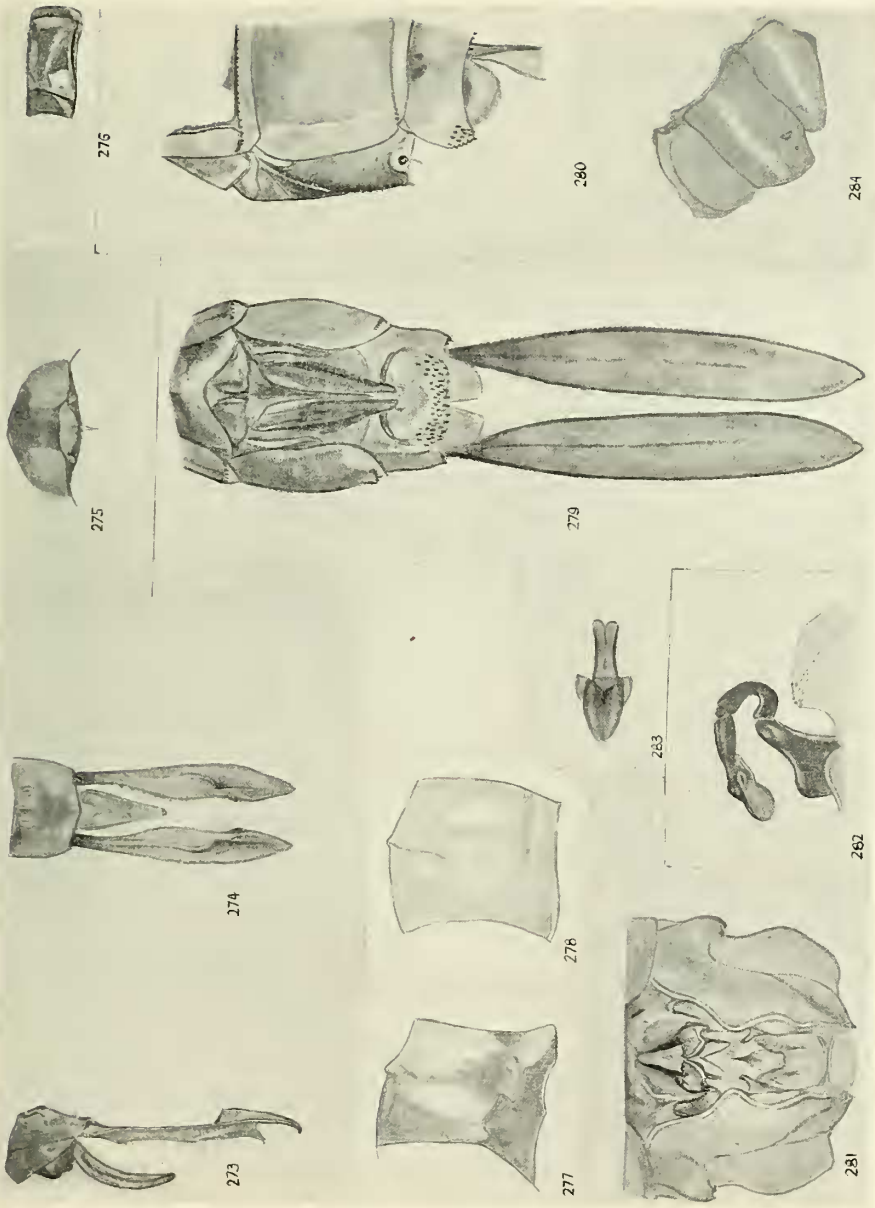
HAARUPL, HESPERAESCHNA



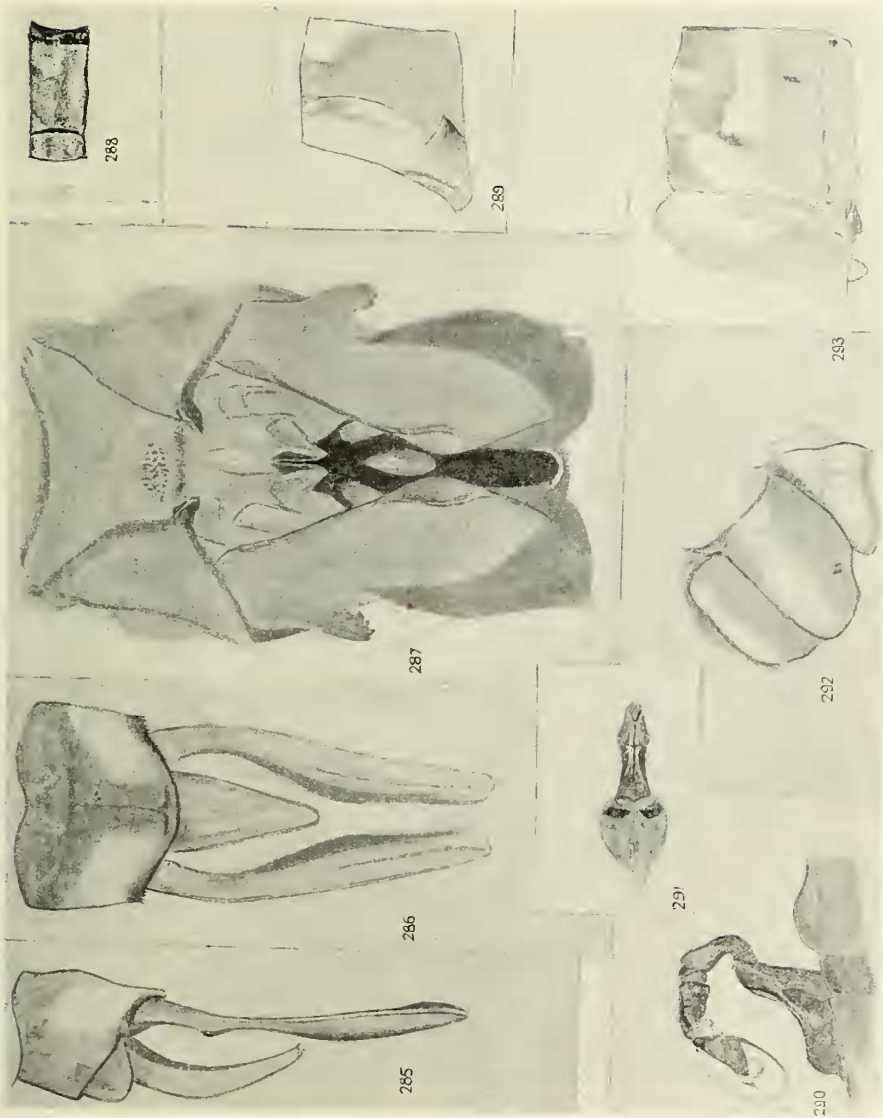
INGENS, CORYPHAESCHNA



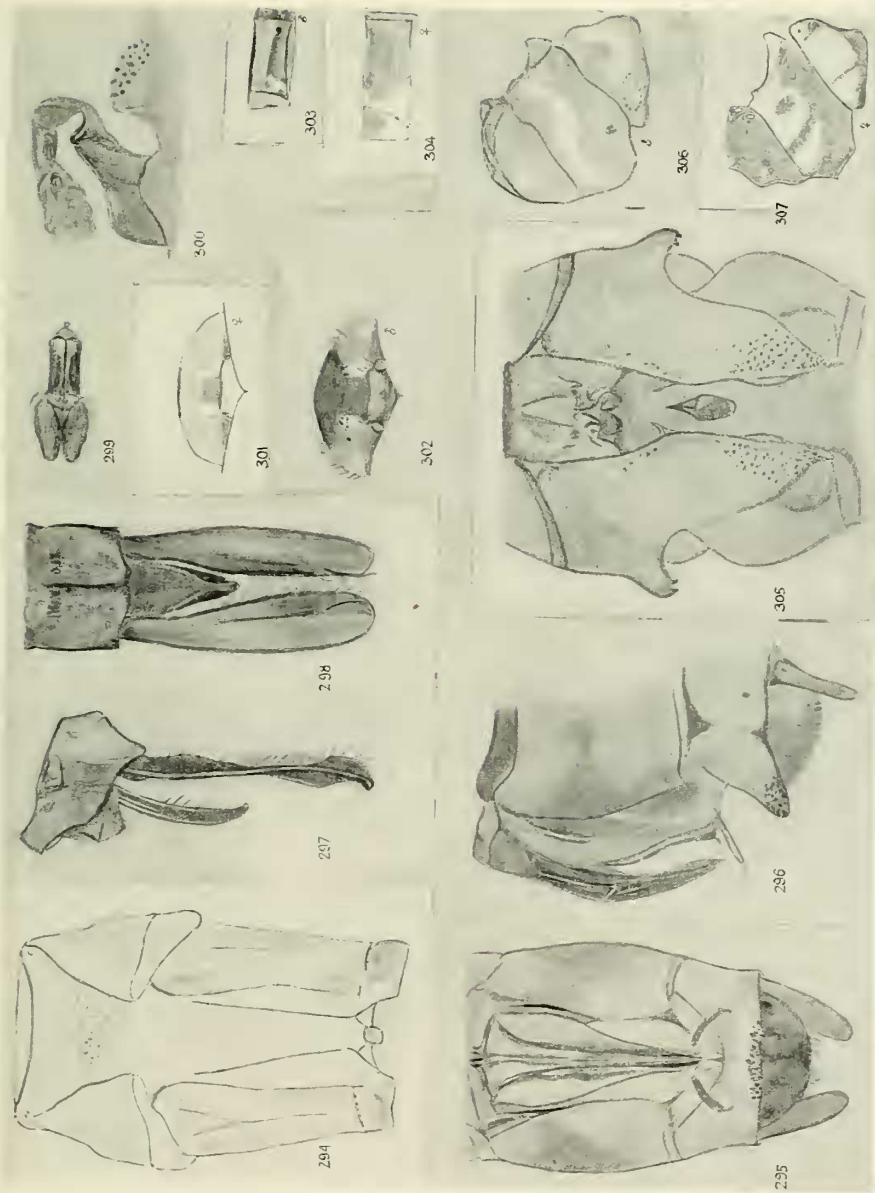
INTRICATA, MARMARAESCHNA



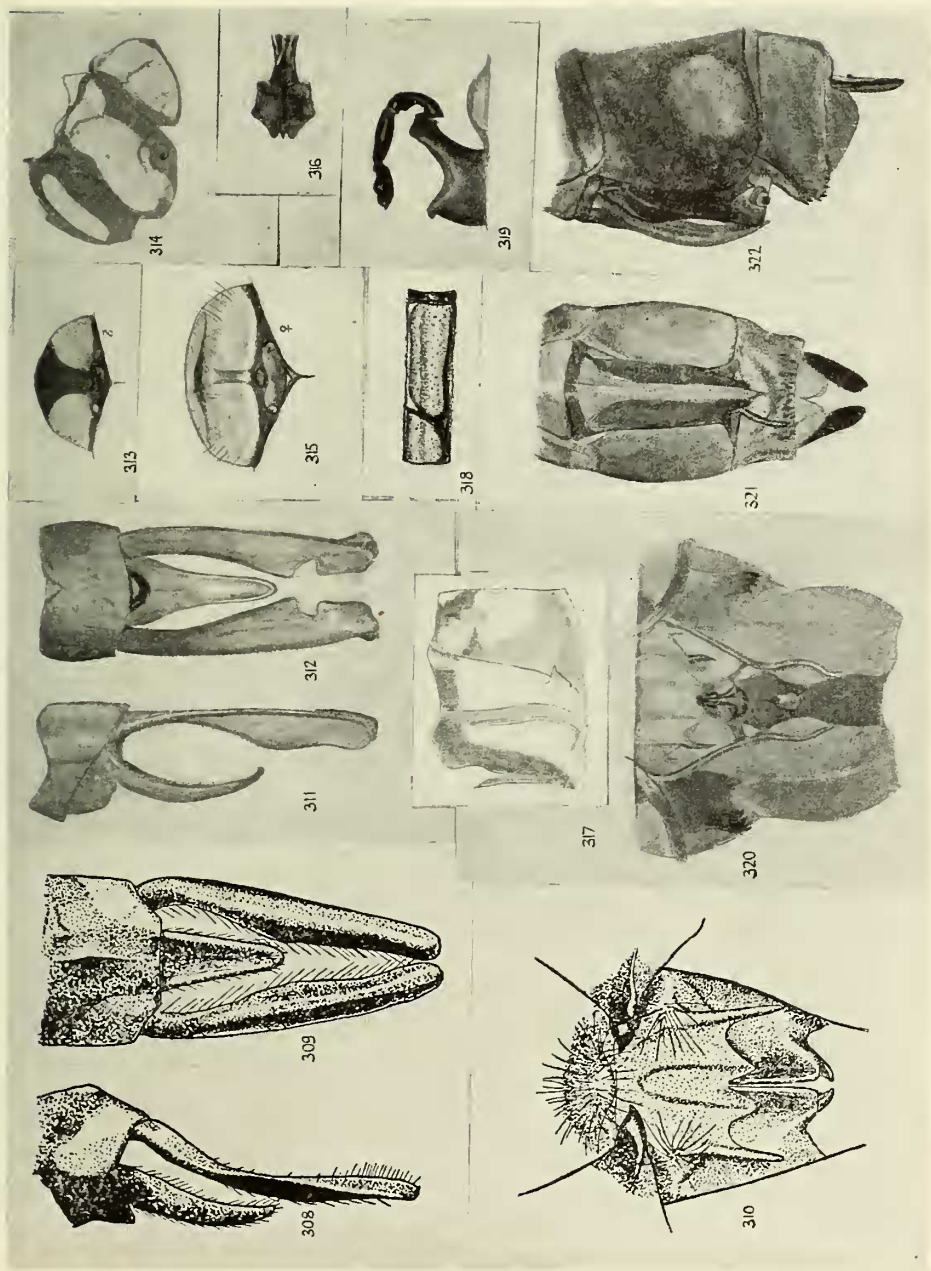
JALAPENSIS, SCHIZURAESCHNA



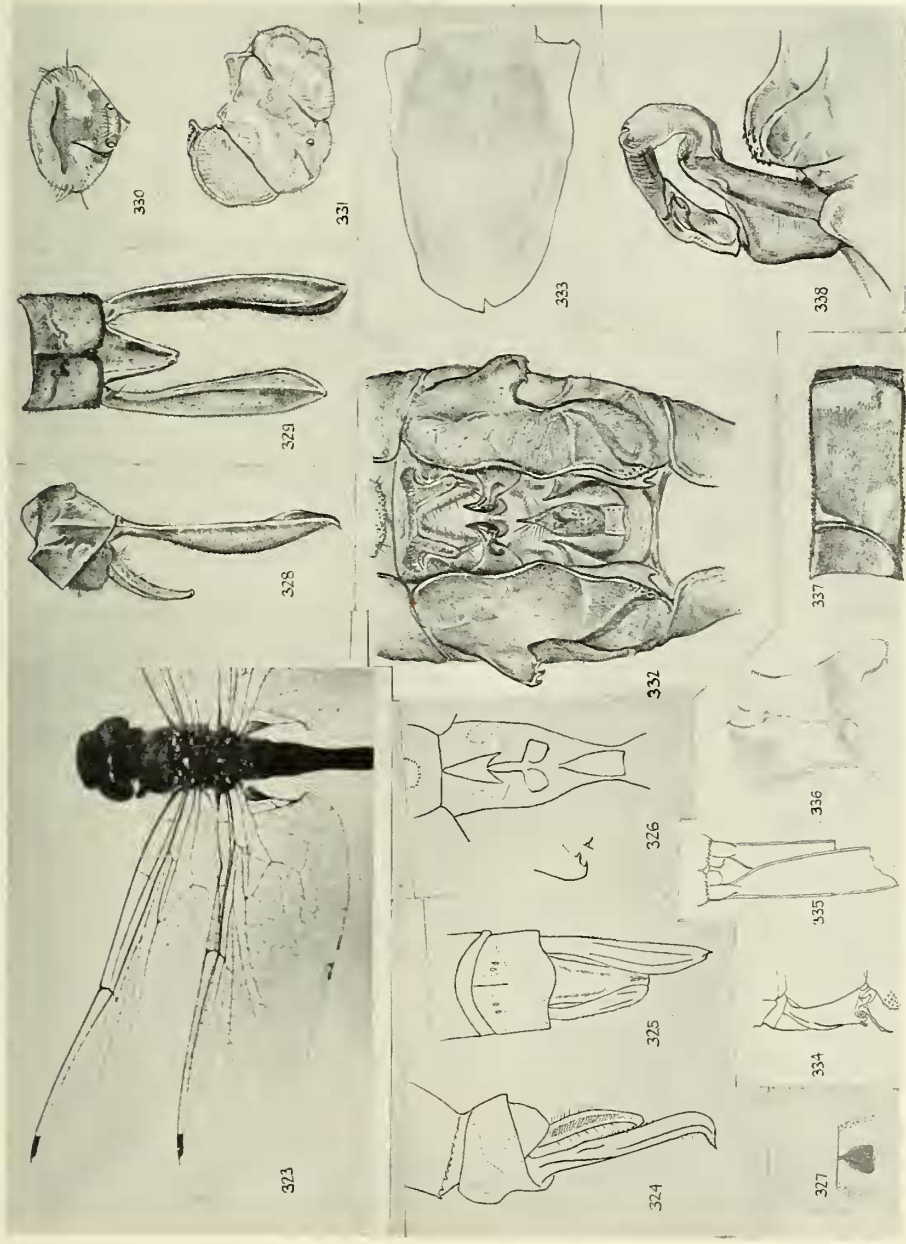
JANUARIA, CASTORAESCHNA



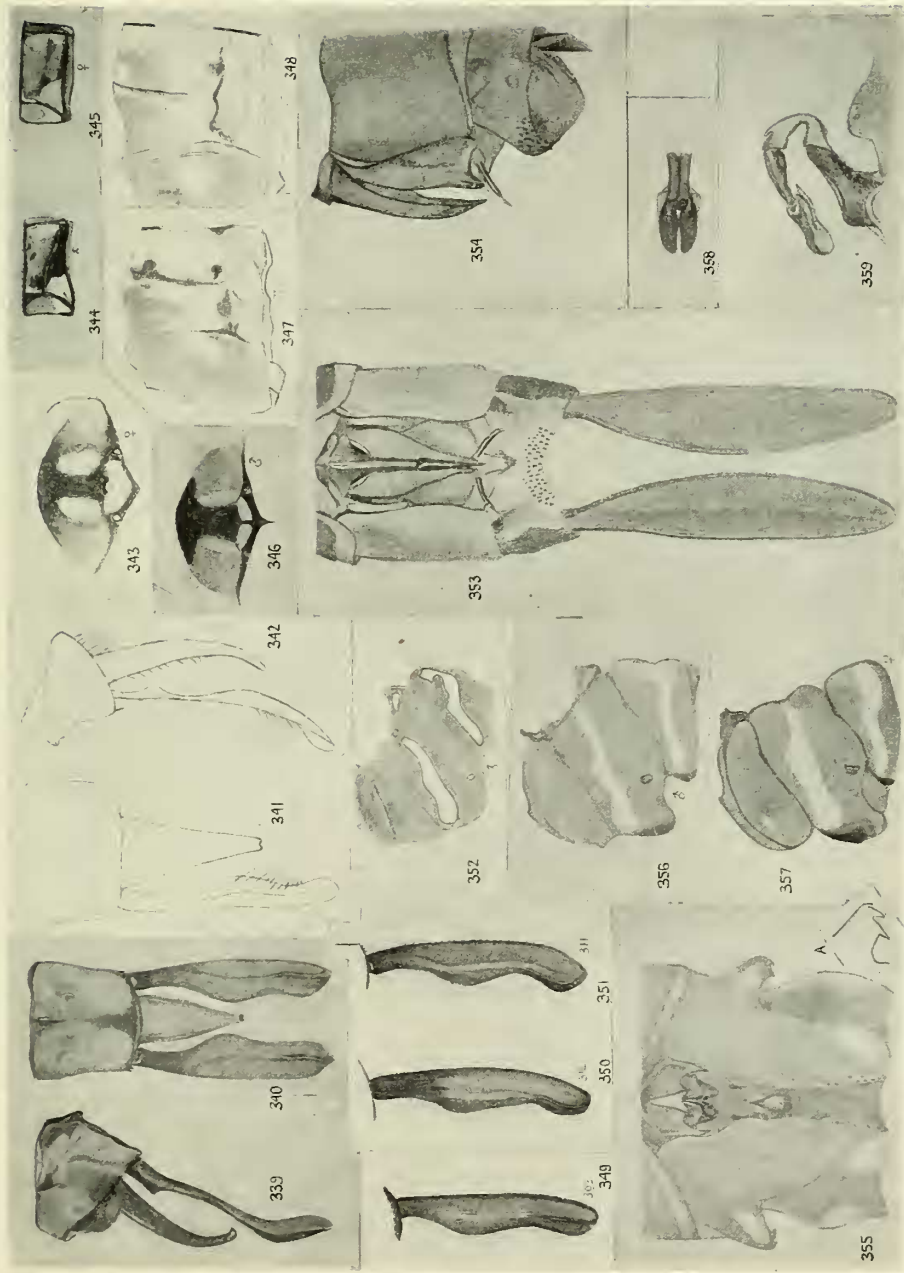
JANUARIA, CASTORAECHNA 294-296, JOANNISI, AESHNA 297-307



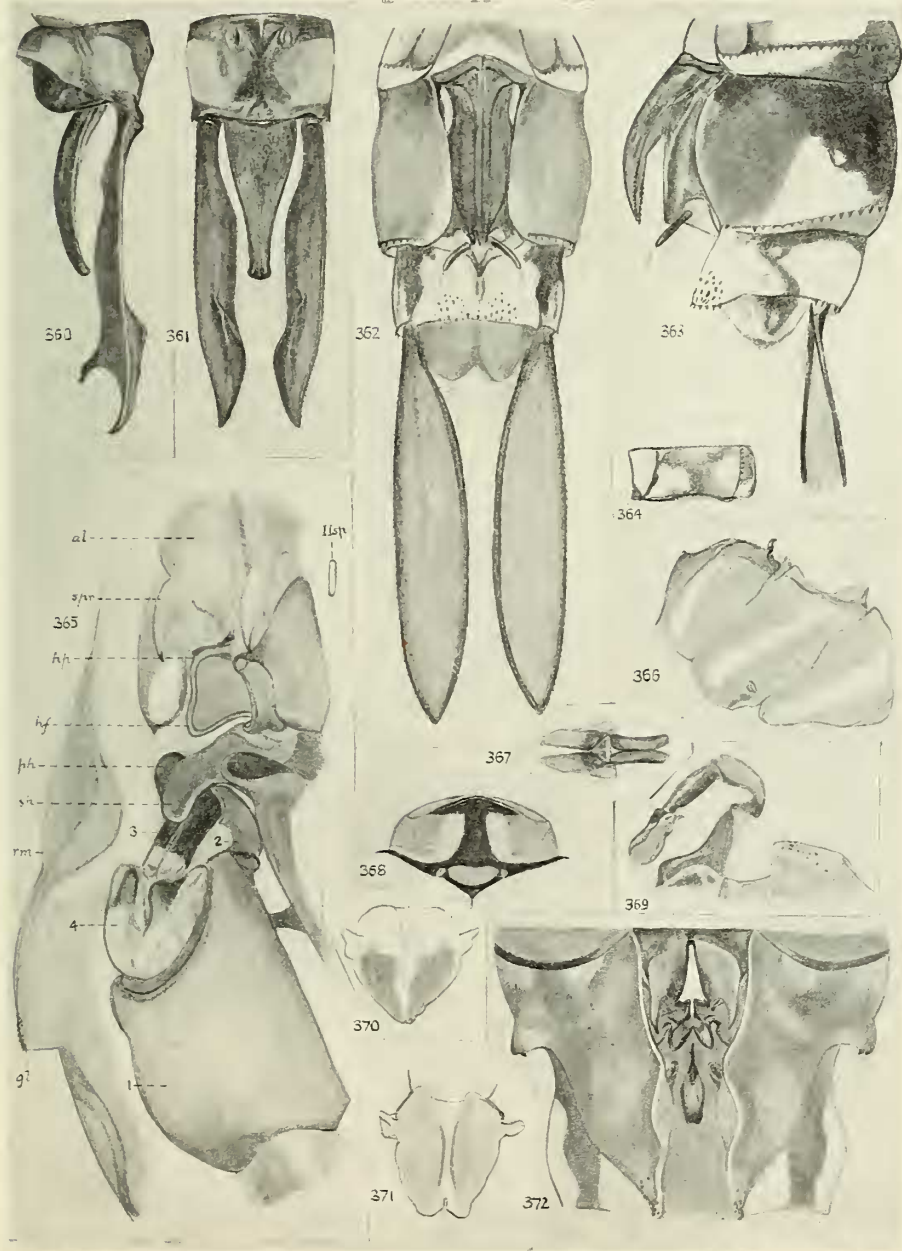
LONGFIELDAE, *CASTORAESCHNA* 308-310, *LUTEIPENNIS*,
CORYPHAESCHNA 311-322



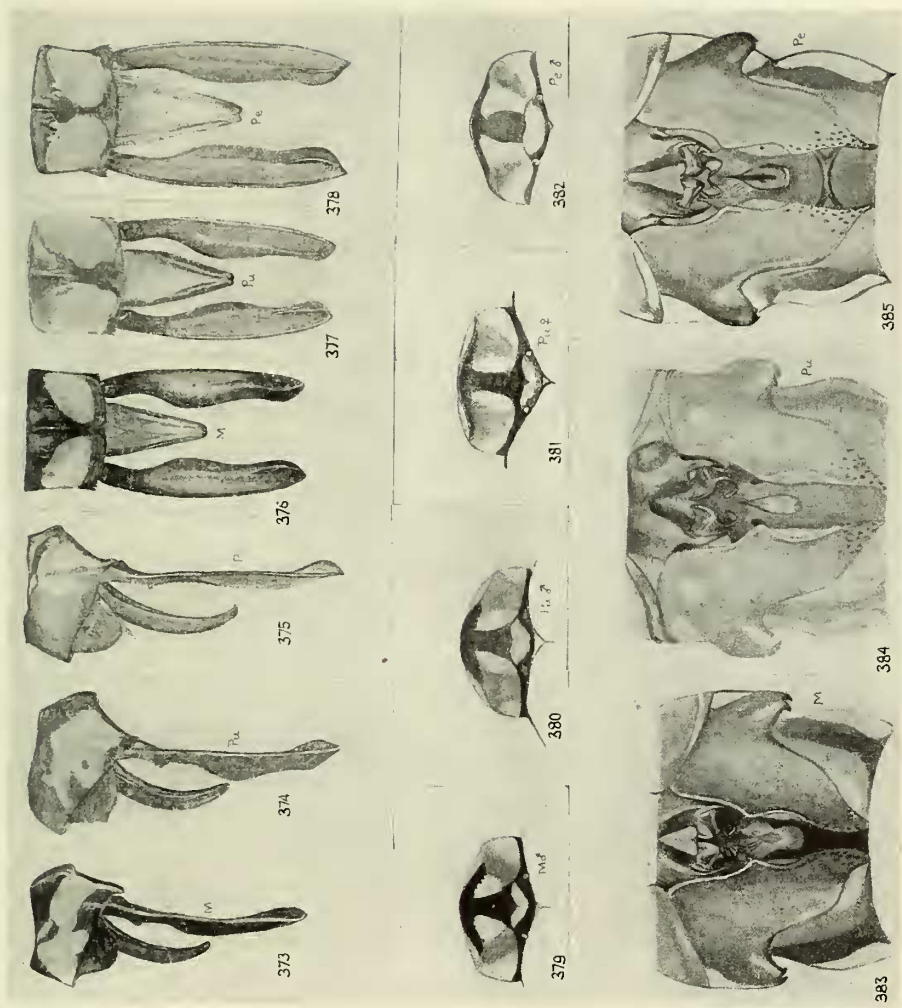
MAITA, RHIONAESCHNA 323-327, MANNI, HESPERAESCHNA 328-333



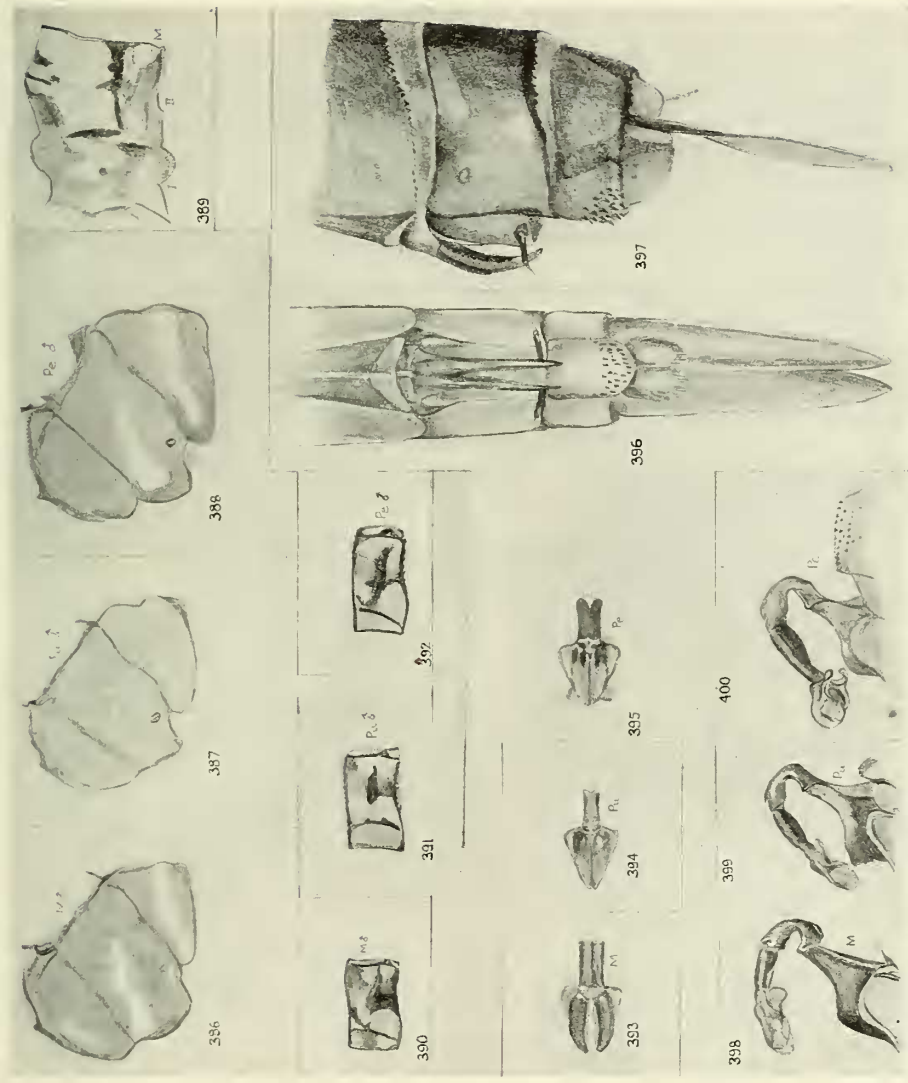
MARCHALI, HESPERAESCHNA



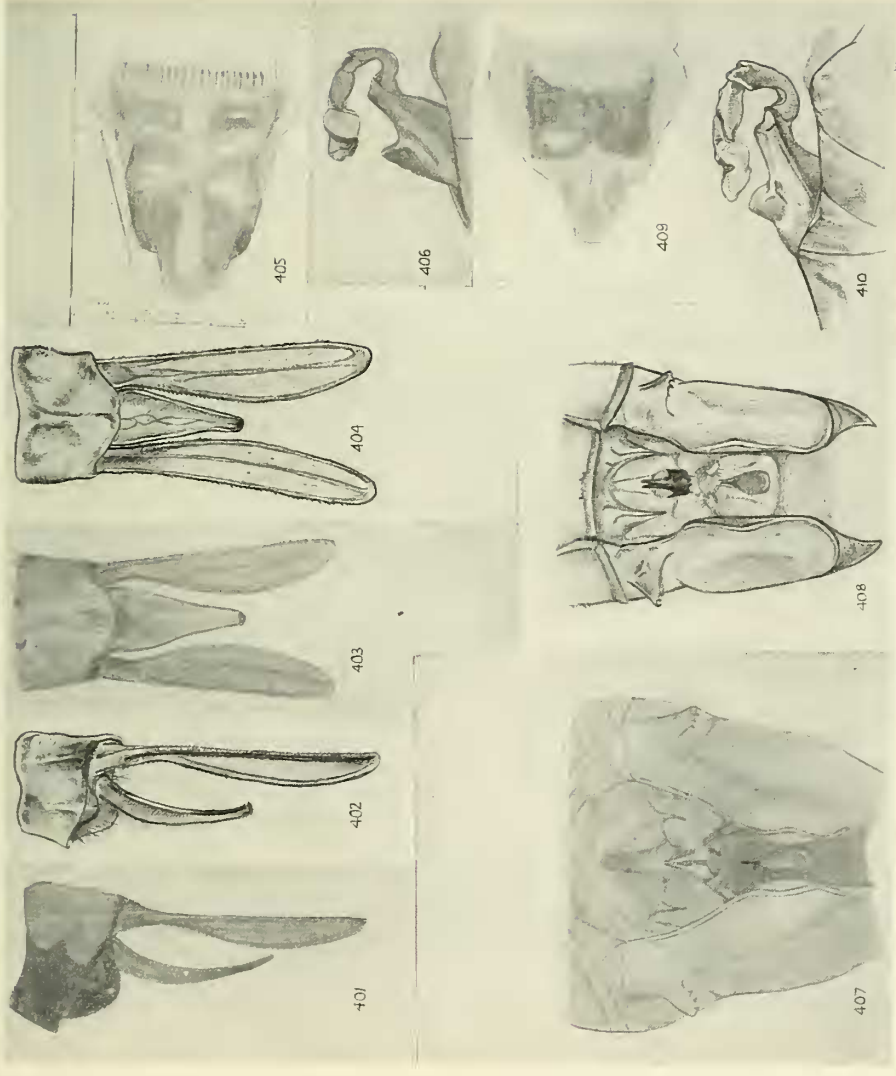
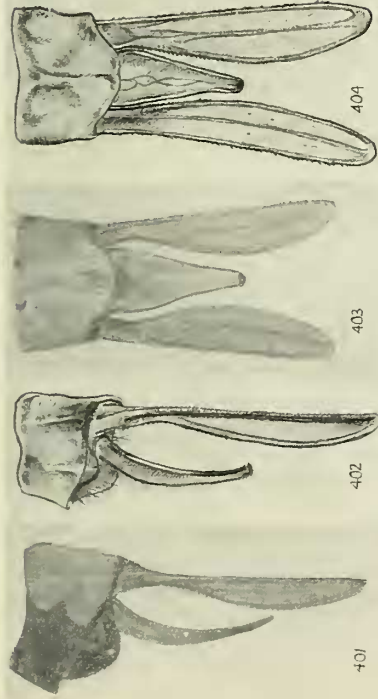
MULTICOLOR, SCHIZURAESCHNA



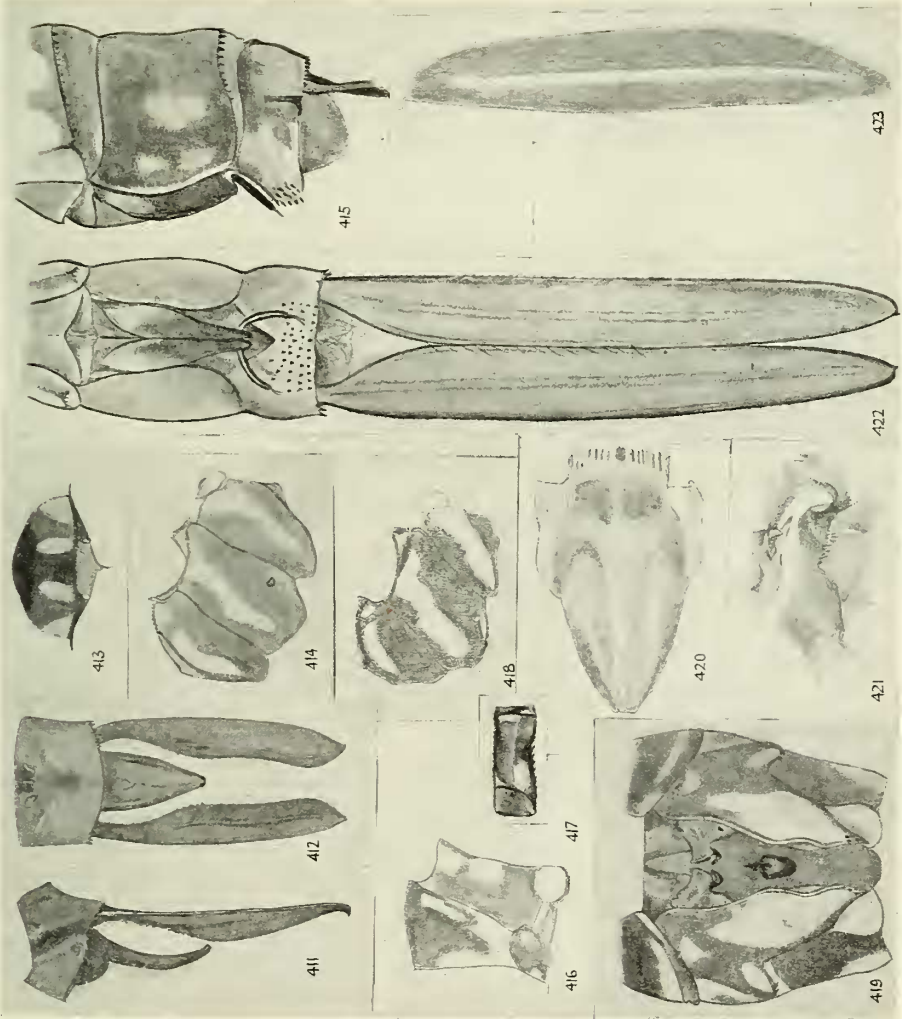
PERALTA, HESPERAESCHNA



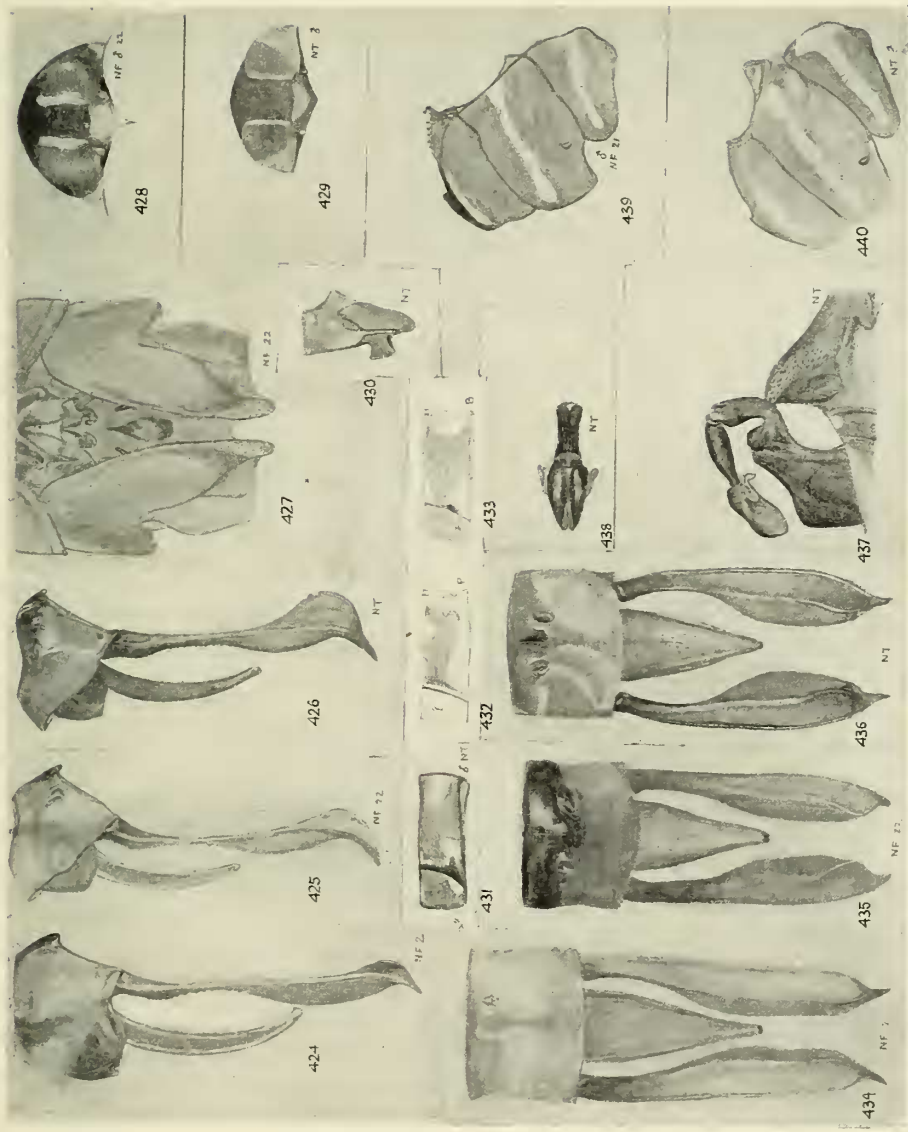
PERALTA, HESPERAESCHNA



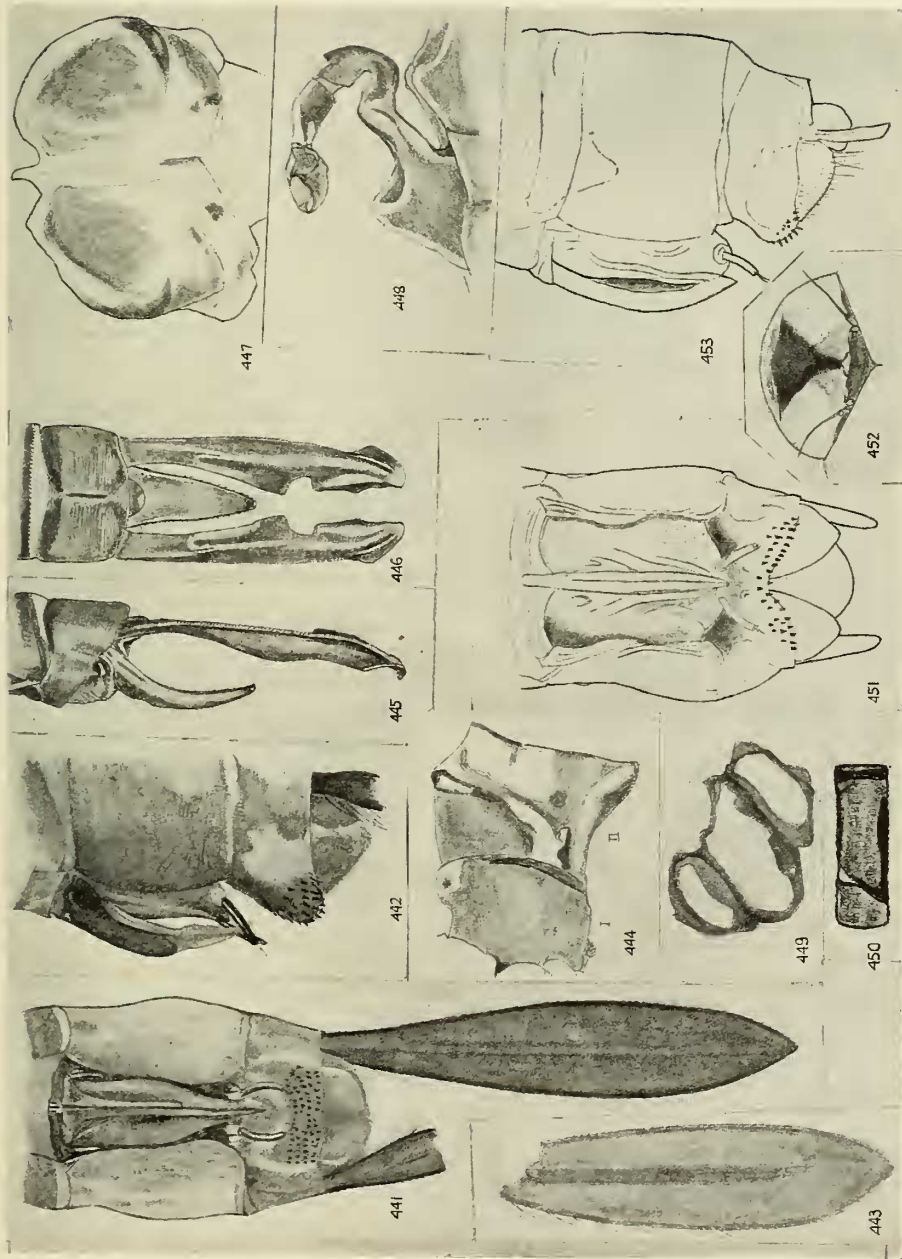
PERRENSI, CORYPHAESCHNA



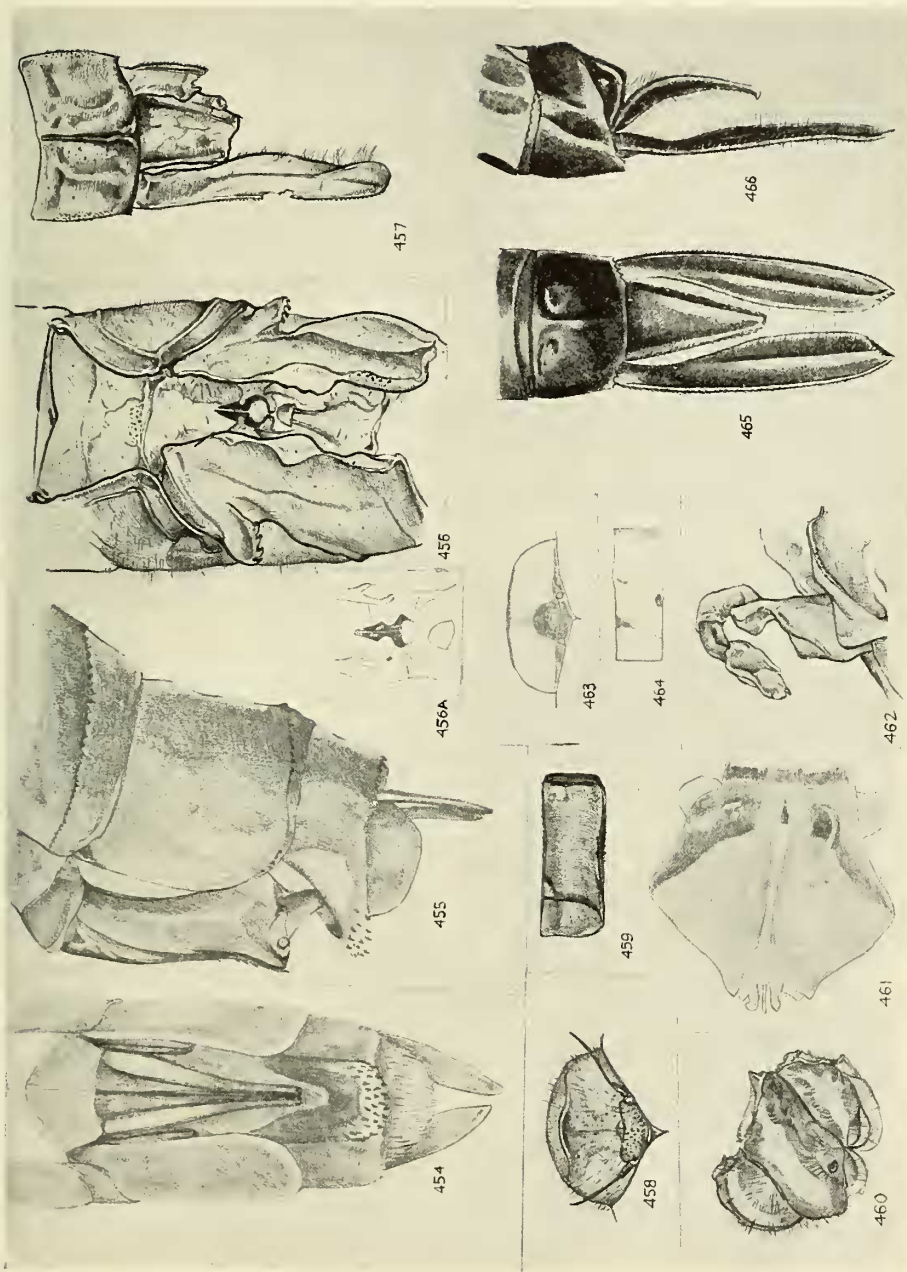
PSILUS, HESPERAESCHNA



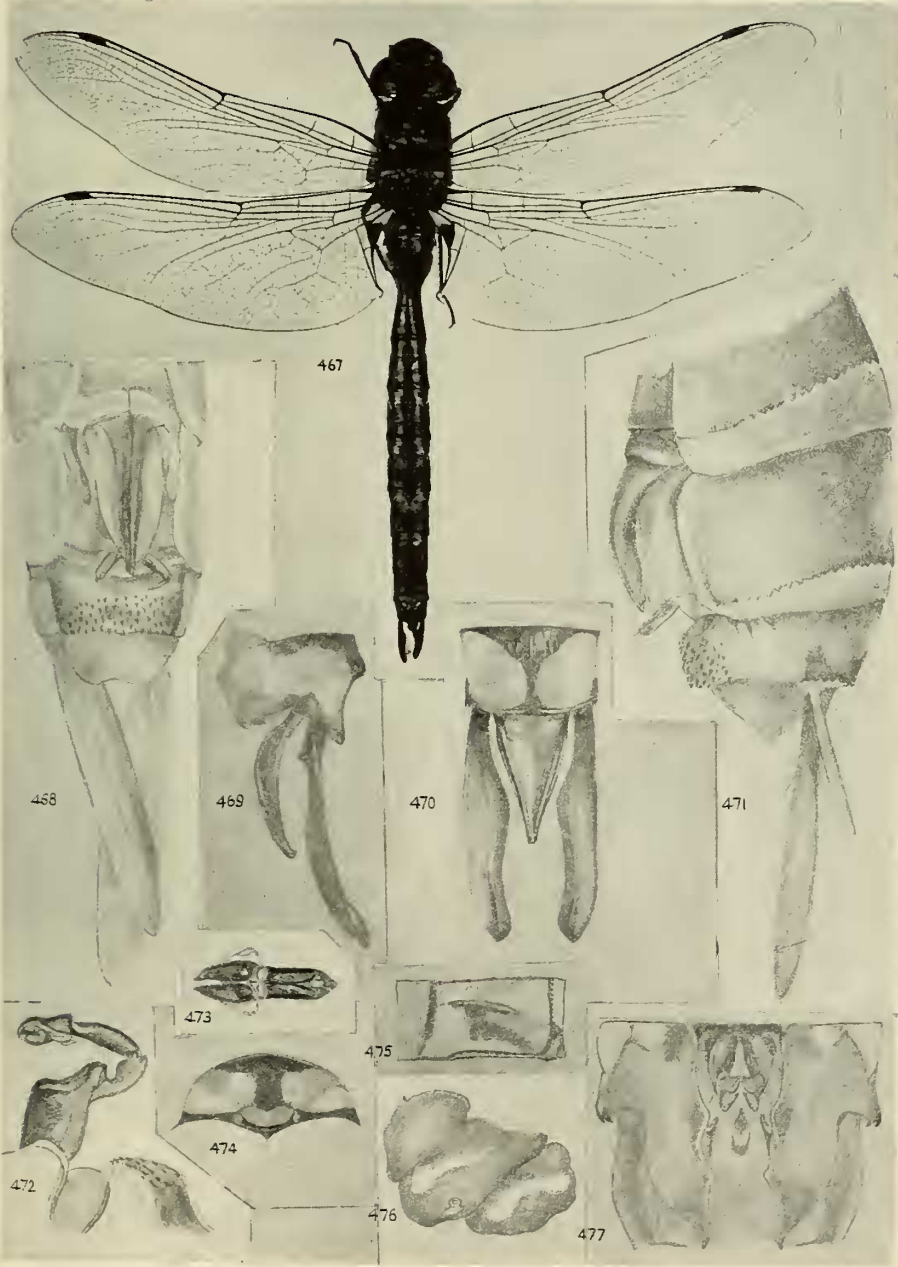
PUNCTATA, HESPERAESCHNA



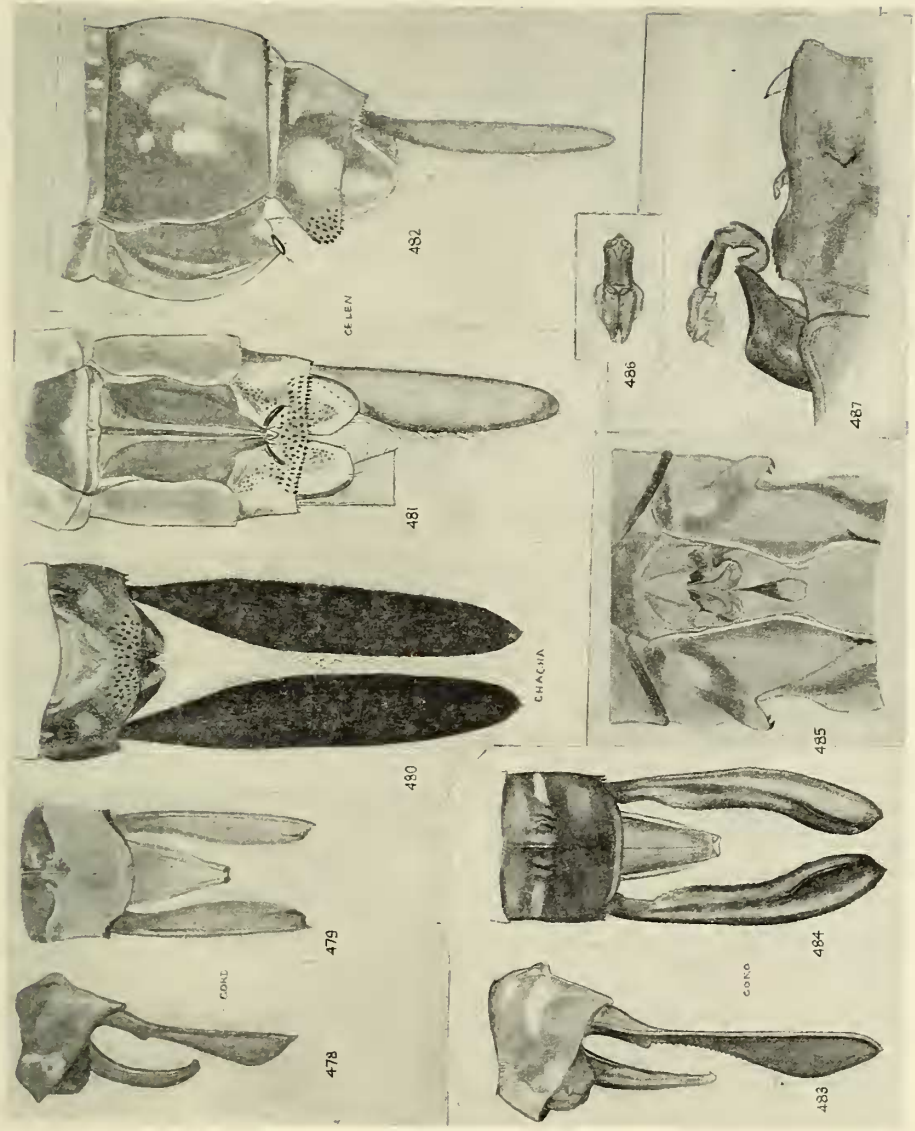
PUNCTATA, AESCHNA 441-444, RUFIPENNIS, CORYPHAESCHNA 445-453



RUFIPES, AESHNA 454-455, SECRETA, CORYPHAESCHNA 456-462,
UNICOLOR, AESHNA 463-466



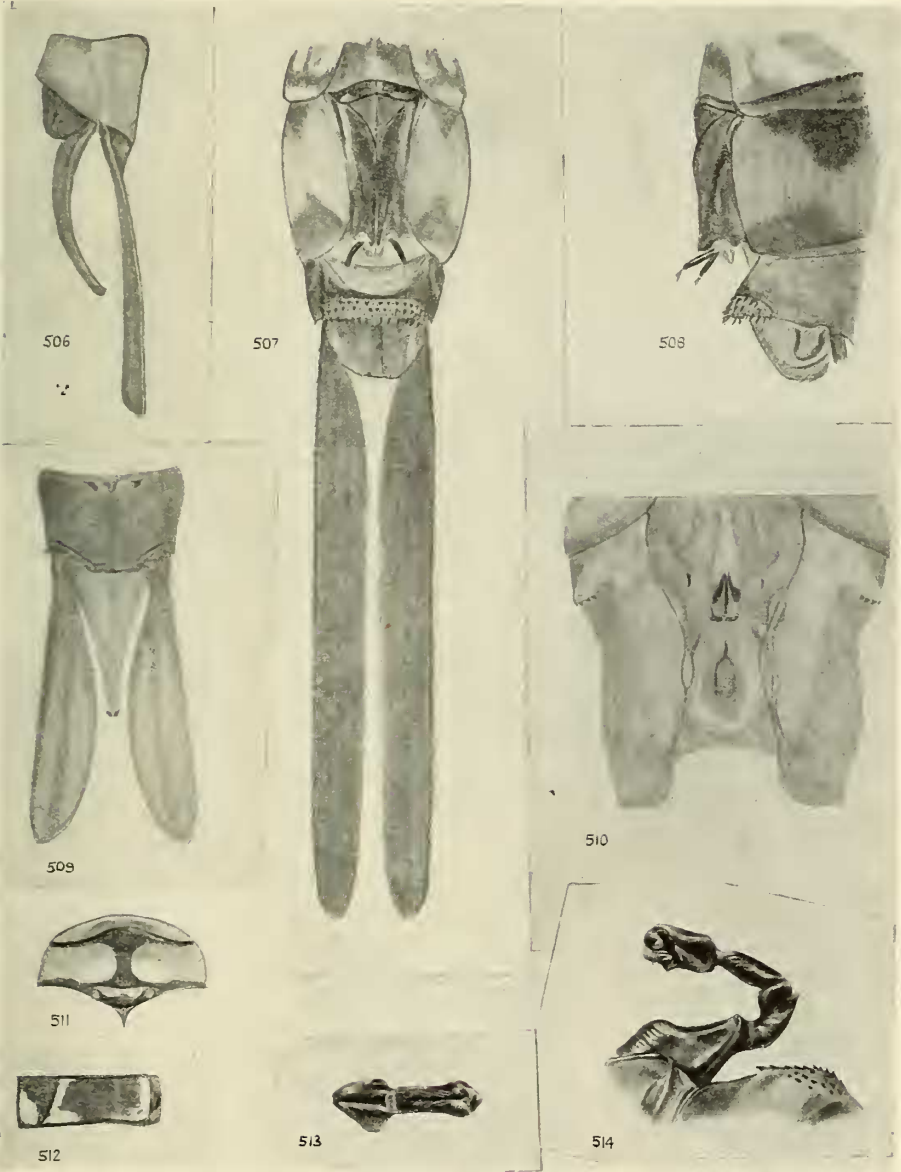
VARIEGATA. HESPERAESCHNA



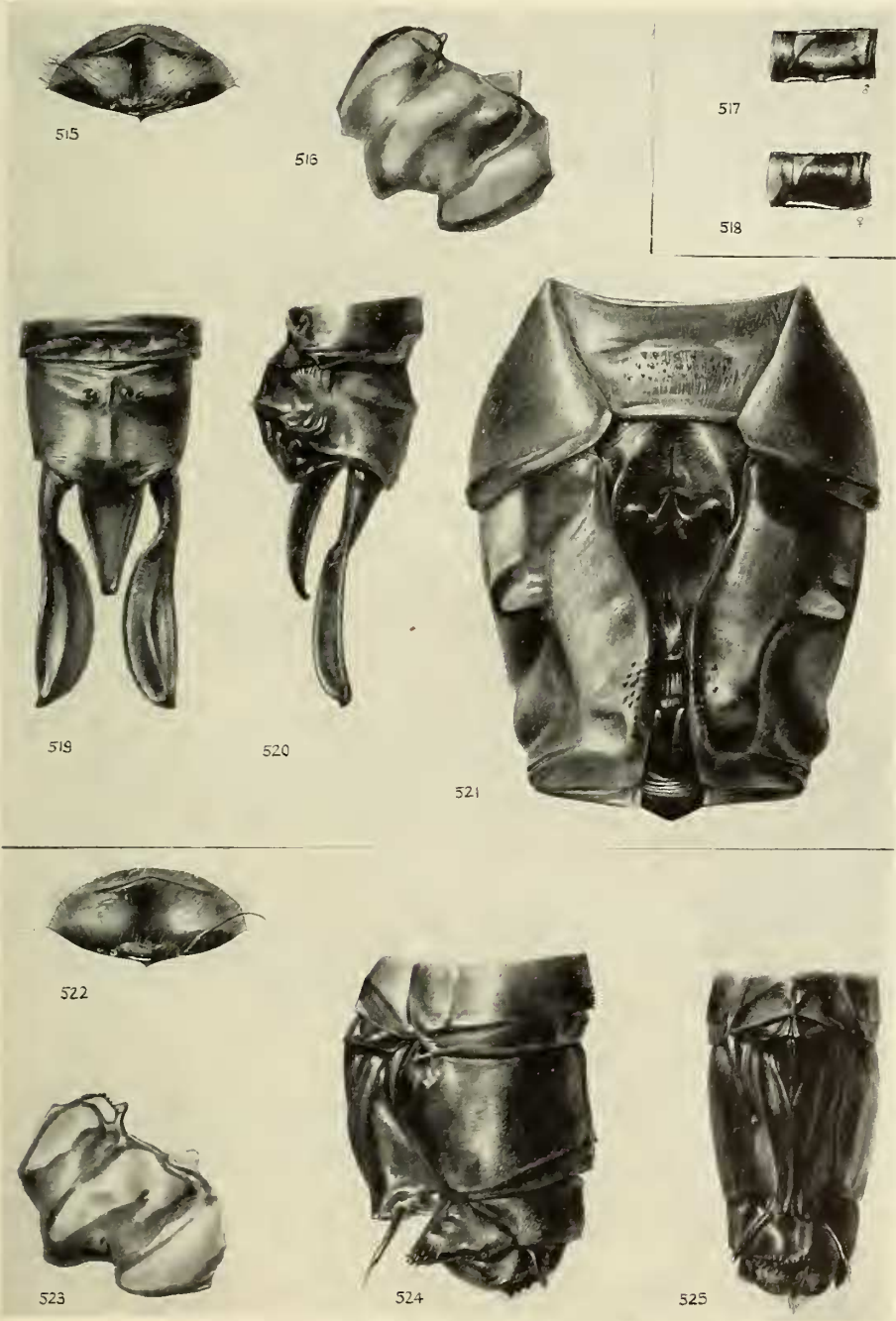
VIGINTIPUNCTATA, MARMARAESCHNA 478, 479, 483-487,
INTRICATA, M. 480-482



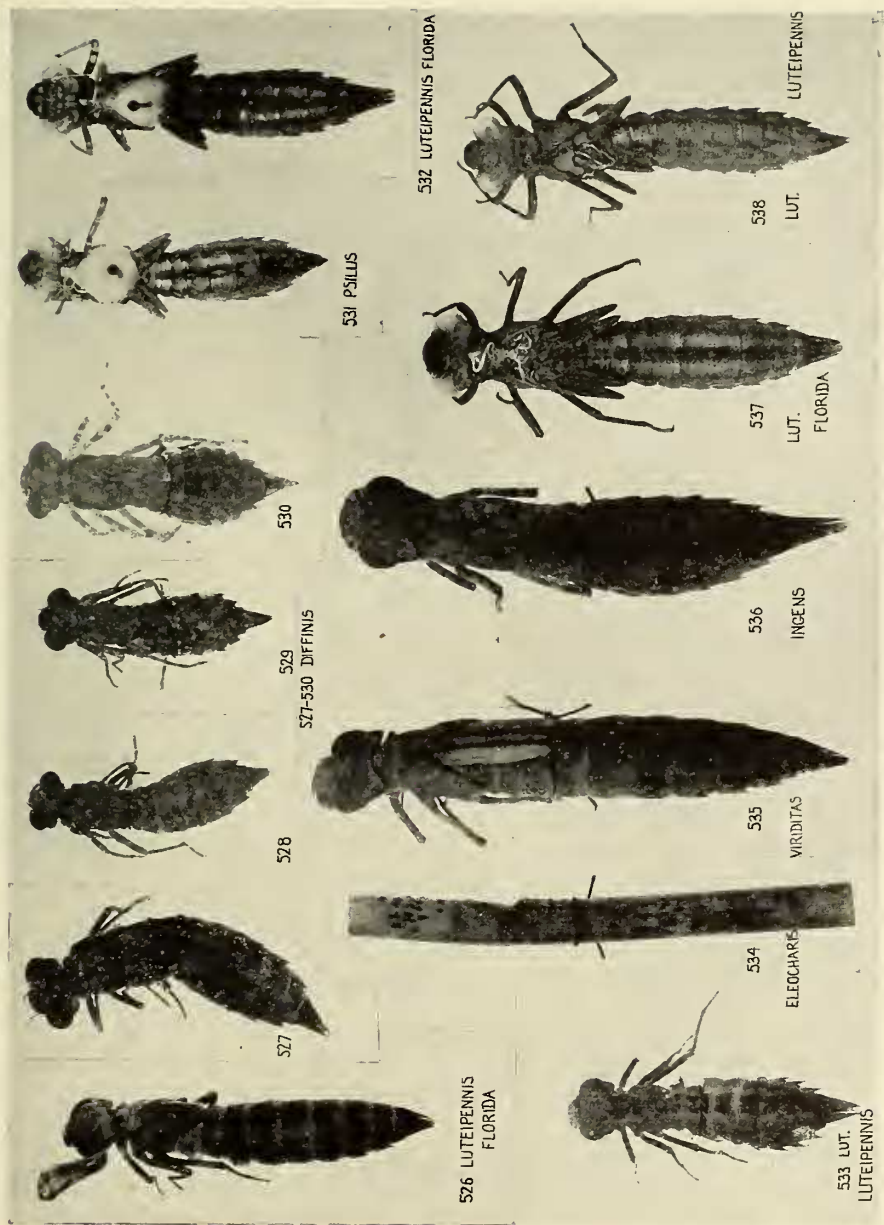
VIGINTIPUNCTATA, MARMARAESCHNA 488, 489, 491-493, INTRICATA, M.
490, 494-499, VIRIDITAS, CORYPHAESCHNA 500-504, ADNEXA, C. 505



VIRIDITAS, CORYPHAESCHNA 506-512, WILLIAMSONIANA,
HESPERAESCHNA 513, 514



WILLIAMSONIANA, HESPERAESCHNA



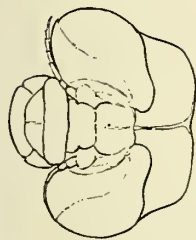
LARVAE & EXUVIAE, VARIOUS SPECIES



539

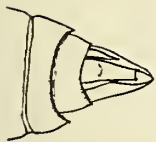


540 6ULT



541

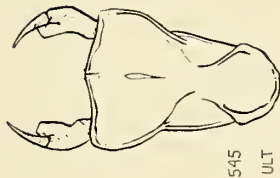
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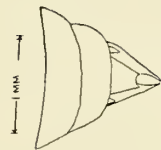
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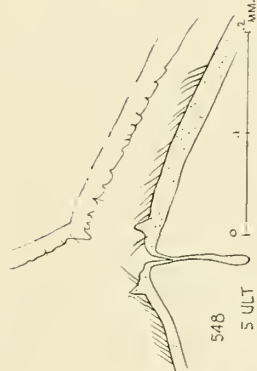
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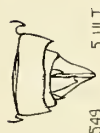
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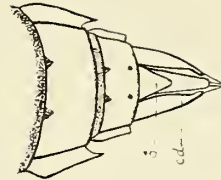
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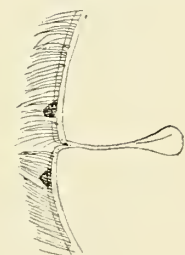
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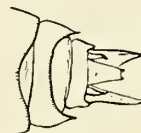
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550 3ULT



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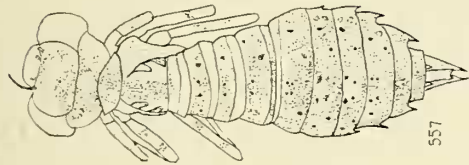
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PSILUS, HESPERAESCHNA, LARVAE

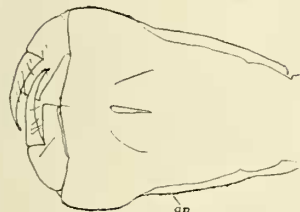
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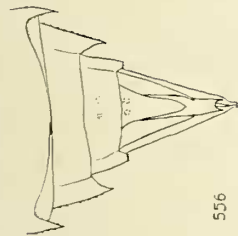
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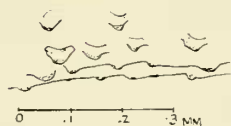
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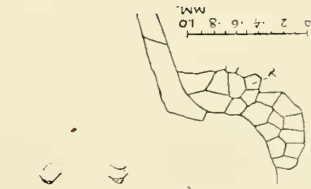
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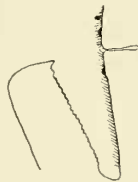
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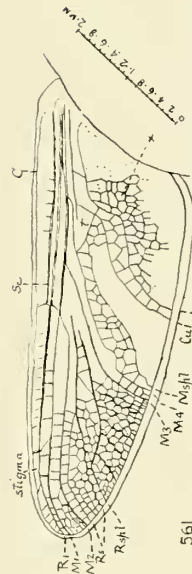
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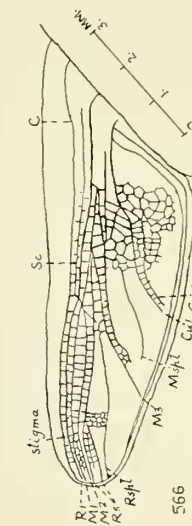
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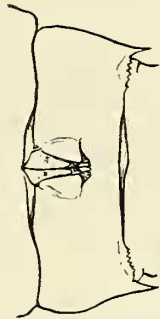
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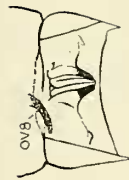
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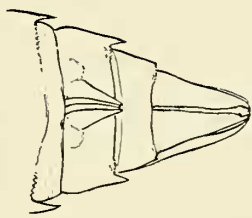
562 3 ULT



563 PENULT or ULT

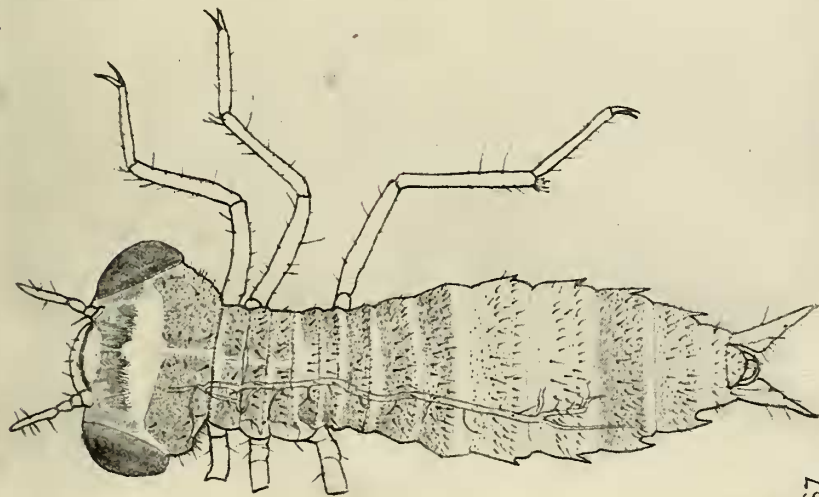


564 ULT

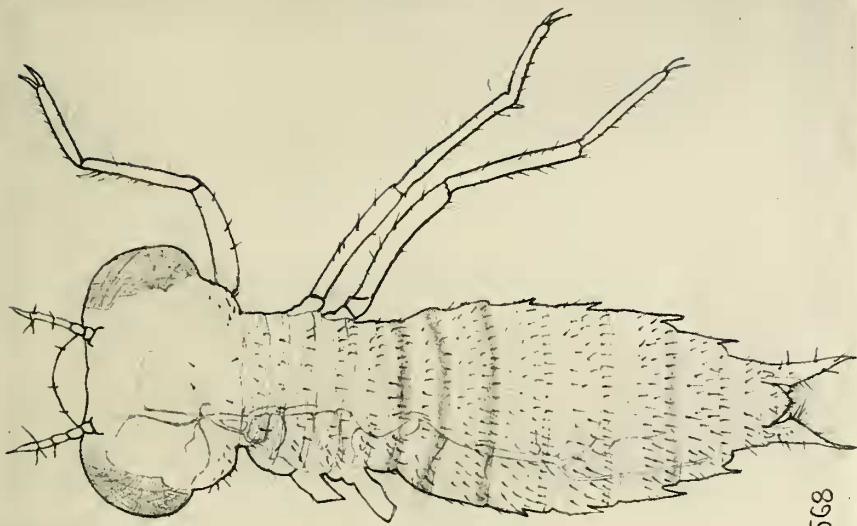


564 PENULT

DIFFINIS, NEURECLIPA 555-561, LUTEIPENNIS FLORIDA,
CORYPHAESCHNA 562-566, LARVAE

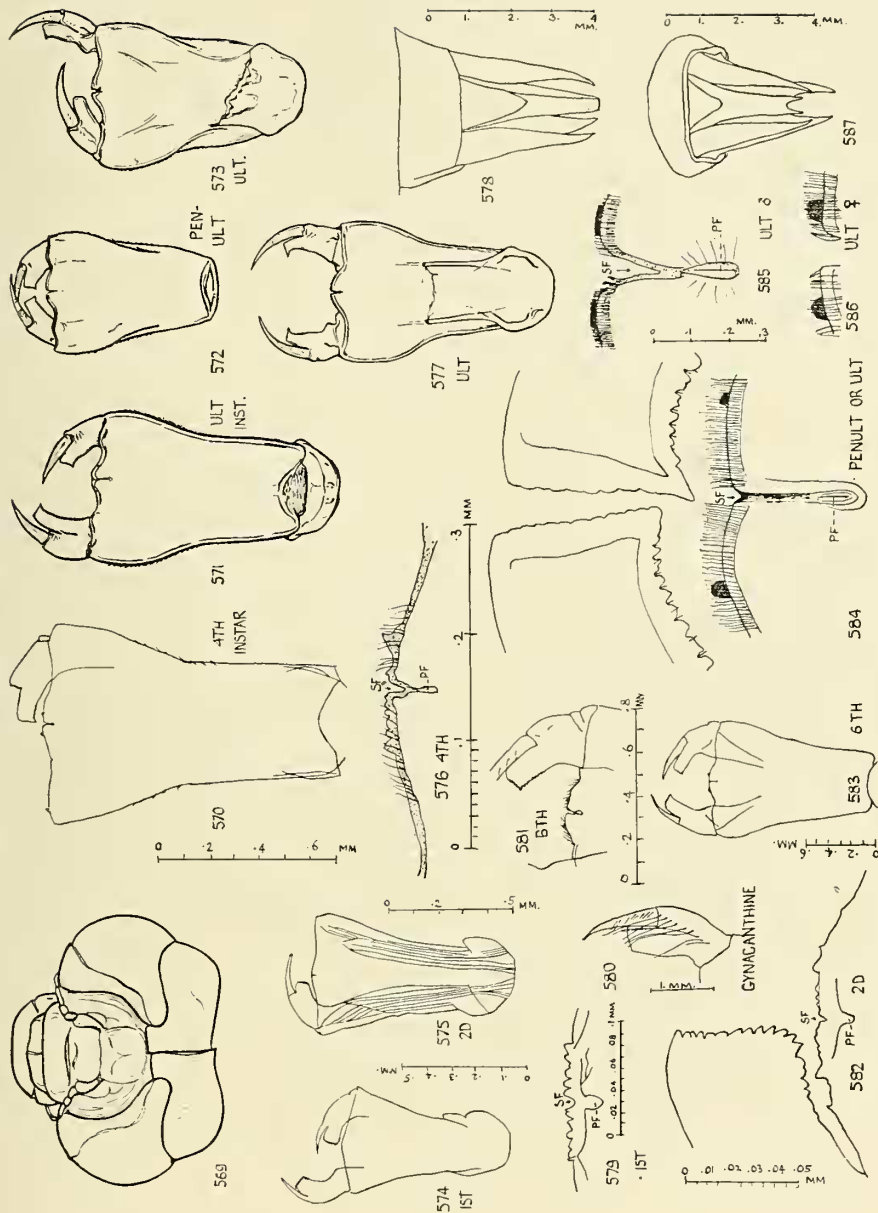


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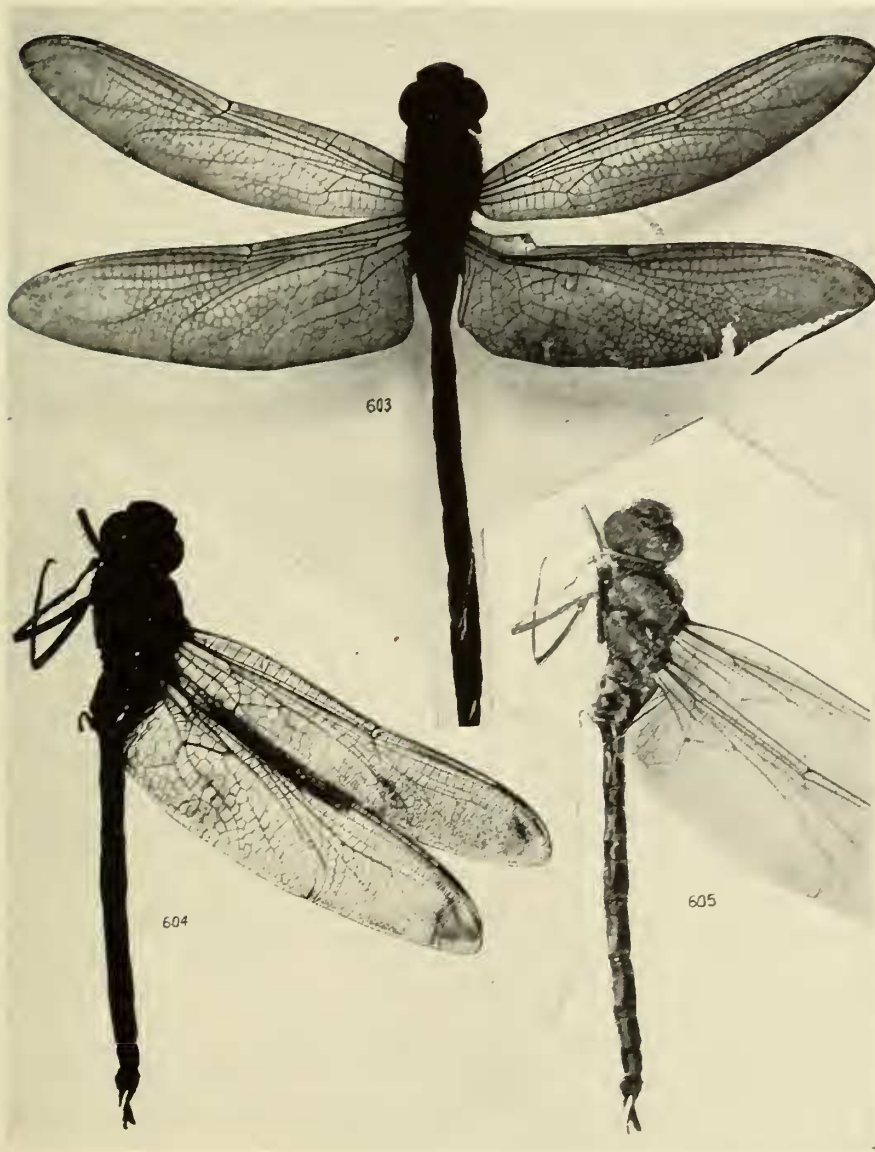


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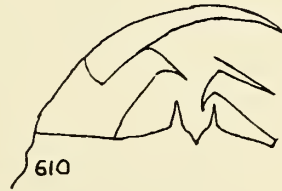
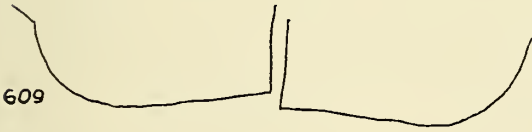
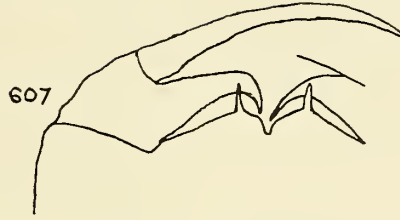
LUTEIPENNIS FLORIDA, CORYPHAESCHNA, LARVAE



LUTEIPENNIS LUTEIPENNIS, CORYPHAESCHNA 587, GYNACANTHINE
580, LUT. FLORIDA, C. ALL OTHER FIGS.



UNICOLOR, AESHNA 603, WILLIAMSONIANA, HESPERAESCHNA 604, 605



LUTEIPENNIS FLORIDA, CORYPHAESCHNA 606, 608, 609, 611-613,
VIRIDITAS, C. 607, 610, 614

Table 1

Species	Specimens Widths (except where height or length is stated) in millimeters									
	Frons		Head		Stem of T-spot		Post. Ant. end		Post. end	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
<i>Ae. unicolor</i>	1	4.56	8.25	10.30	57	1.14	65	2.04		
<i>Ae. rufipes</i>	9	4.25	8.82	8.66	82	1.88	82	2.21		
<i>H. californica</i>	2	4.75	8.26	8.64	33	80	24	65		
<i>H. haerupi</i>	2	3.93	8.34	8.84	74	1.23	165	74		
<i>H. williamsoniana</i>	1	4.34	10.5	9.80			1.23	1.07?		
<i>H. confusa</i>	5	5.5	7.36	7.28	57	65	41	57		
		3.68	7.90	7.68	74	90	65	74		
<i>H. cornigera</i>	20	4.17	8.00							
<i>o. cornigera</i>	3	4.34	8.68							
		4.91	8.18							
<i>o. planaltioa</i>	16	4.06	8.50							
		4.58	7.85							
<i>H. psilus</i>	5,2	3.93	9.05							
		4.50	8.50							
<i>H. manni</i>	3	4.50	8.84							
		4.58	8.00							
<i>H. marohali</i>	6-	4.58	9.08	8.75	57	90	65	98		
	11	5.15	8.34	9.16	1.06	1.23	98	1.14		
<i>H. peralta</i>	7,6	4.25	8.68	7.84	47	80	41	90		
		4.73	10.48	10.62	71	1.65	66	1.09		
<i>H. billosa</i>	3	5.65	11.00		1.14	1.14	5	1.39		
		6.10	9.42		1.3	1.3		1.47		
<i>H. joannisi</i>	2	5.56	9.48		1.06	1.06				
		5.73	8.50		1.14	1.14				
<i>H. punotata</i>	4	4.20	10.00		1.06	98				
	5	5.20	11.44		1.39	1.31				
<i>H. decessus</i>	1	5.40	8.84	10.00	1.39	1.39				
<i>H. variegata</i>	7	4.58	9.49		41	89	5	1.06		
		5.15	9.74		82	2.04				
<i>S. multicolor</i>	5	4.83	9.16	9.16	57	1.31	65	1.31		
		5.15	10.00	9.50	90	1.88	82	1.64		
<i>S. jalapensis</i>	5	4.74	9.50	9.40	1.06	1.80	1.14	1.88		
		5.07	10.86	10.38	1.39	1.96	1.23	2.21		
<i>S. dugesi</i>	1	4.91	10.00	9.50	90	1.39	78	1.60		

Table 2

Species	Specimens measured	Widths (except where height or length is stated) in millimeters									
		Frons		Head		Stem of T-spot		Post. Ant.		Post. end	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
<i>M. brevifrons</i>	13	7	5.24	5.56	8.18	8.68					
			-6.30	-6.30	-9.24	-9.16					
<i>M. intricata</i>	9	9	5.23	5.07	8.34	8.50					
<i>M. vigintipunctata</i>	8	1	-6.13	-6.30	-10.78	-10.78					
			4.50	6.30	9.00	9.80					
<i>M. pallipes</i>			-5.65		-10.46						
<i>N. diffinis</i> diff.			(no data)								
<i>N. pacific</i> slope	5	6	3.97	4.16	7.94	8.08					
			-4.6	-4.6	-8.34	-8.34					
<i>Atlantic</i> slope	4	6,7	3.68	3.76	7.78	7.70					
			4.04	-4.25	-8.42	-8.34					
<i>N. diff. absoluta</i>	5	6	3.68	4.00	7.52	7.60					
			-4.09	-4.34	-8.00	-8.18					
<i>N. elisa</i>	6	5	3.76	4.09	8.18	7.36					
			-4.50	-4.66	-8.50	-8.50					
<i>N. galapagoensis</i>	4	5	4.17	4.09	8.18	7.86					
			-4.58	-4.50	-8.82	-8.68					
<i>N. bonariensis</i>	5	5	3.68	3.76	7.36	7.78					
			-4.00	-4.09	-7.94	-8.18					
<i>Co. luteipennis</i> lut.	4		4.00		9.66						
			-4.83		-10.00						
<i>Co. rufipennis</i>	4	1	4.25	4.70	9.00	10.00					
			-4.66		-10.00						
<i>Co. secreta</i>	1		4.83		10.00						
<i>Co. viriditas</i>	5	9	5.07	4.58	9.80	9.80					
			-6.73	5.32	-11.45	-12.27					
<i>Co. perrensi</i>	5		4.50		9.16						
			-5.00		-10.00						
<i>Ca. januaria</i>	2	2	4.91	5.15	10.14	10.80					
			-5.40	-5.73	-10.88	-11.30					
<i>Ca. colorata</i>	1	1	4.00	4.50	9.08	damag'd					
			4.75	5.16	10.80	10.64					
<i>Ca. oastor</i>	5	2	-5.73	-5.40	-11.38	-10.88					
			5.15		10.64						
<i>Ca. coronata</i>	5		-5.32		-10.88						

Table 4

Species	Specimens measured	Widths (except where height or length is stated) in millimeters									
		Mesepimeral Stripe		Metepimeral Stripe		Metepimeral Stripe		Metepimeral Stripe		Abd. seg. 2 max.	
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
M. brevifrons	♂ 9	Super. end 0	Infer. end 0	Super. end 0	Infer. end 0	Super. end 0	Infer. end 0	Super. end 0	Infer. end 0		
N. diff. absoluta	5 6	.65	.41	.82	.49	.57	.41	.65	.49		
N. elsaia	6 5	-1.23	.82	-1.65	-.82	-1.23	-.65	-1.23	-.65		
		.90		1.06		1.23		.82			
				-1.23				-1.64			
Co. luteipennis lut.	4	2.78	.98			2.45	.65				
		-3.44	-2.62			-2.68	-.98				
Co. rufipennis	4 1									4.42	5.5
Ca. januaria	5 2	2.45	.41	2.45	2.04	2.21	.49	2.45	2.04	-4.90	6.05
		-2.95	-2.45	-4.0		-3.68	-.90	-4.00	.82	5.24	
Ca. oastor	4 2	2.29	.90	2.21	1.31	2.86	.24	2.05		5.16	5.40
		-2.37	-1.06	-2.45	-1.39	-3.03	-.40			-5.56	-6.14
Ca. colorata	1 1	2.86	2.13	2.60	.71	2.37	1.23	2.60	.85		
Ca. coronata	5, 3	1.96	.74			2.45	.65			5.24	
		-2.95	-.98			-3.27	-.82			-5.32	
<hr/>											
		Abd. seg. 3 min.	Abd. seg. 4 ← hind end →	Abd. seg. 9	Height	Ventr. seg. 1	Length	Spines ant. lamina			
		♂	♀	♂	♀	♂	♀	♂			
Ae. rufipes	1										
H. californica	6 3	2.86	2.46	3.19	.33	.29					
					-.49	-.33					
H. baarupi	2 2	1.64	1.96	2.37	1.96	2.70	2.29	.33	.41	.41	.74
		-1.72	-2.21	-2.45	-2.78	-2.54		.53	-.61		
H. williamsoniana	1										
H. confusa	3	1.06	1.39	1.80	1.72	2.12	1.65	.33		.65	.98
		-1.39	-1.55	-2.53	-2.62	-2.13		.41	.28		
H. corn. cornigera	3 3	1.55	1.47	2.37	1.72	2.37	2.70	.5		.5	.8
		-1.88	-2.62	-2.62	-2.45	-2.78		.65			
H. corn. planaltioa	3 4	1.47	1.65	2.21	1.72	2.37	2.45				
		-1.64	-2.37	-2.37	-2.37	-2.70	-2.78				

Table 6

Species	Specimens* tabulated	Sex	Venational Details, both sexes together, except where male only is stated. Percentages in parentheses () m indicates majority but less than 100 %. FW front wings, HW hind wings								
			Distal thicker antenodal		Supratrangular		Disoidal		Triangle		Total Cells
			FW	HW	FW	HW	FW	HW	FW	HW	
<i>Ae. unicolor</i>	2,1	♂	8th {50} 9th {50}	5th {100}	4 {50} 5 {25} 3 {25}	3 {50} 2 {50}	4 {50}	4 {100}	5 {50}	4 {100}	
<i>Ae. rufipes</i>	1	♀	8th {50}	7th {100}	4 {100}	2 {100}	5 {50}	4 {100}	6 {50}	4 {100}	
<i>H. californica</i>	11	4	5th {93} 5th {7}	5th {82} 5th {11}	2 {87} 1 {13}	2 {77} 1 {23}	4 {73} 3 {20}	4 {83} 3 {17}	4 {73}	3 {20}	
<i>H. bearpul</i>	2	2	5th {75} 4th {12}	5th {53} 5th {25}	3 {75}	2 {100}	4 {88}	4 {88}	5 {7}	5 {12}	
<i>H. williamsoniana</i>	1	1	5th {50}	5th {50}	3 {75}	2 {100}	4 {88}	4 {88}	5 {12}	5 {12}	
<i>H. confusa</i>	5	5	5th {50}	5th {80}	2 {100}	2 {80}	4 {100}	4 {95}	4 {100}	4 {95}	
<i>H. oorn. oornigera</i>	10-12	5-7	4th {40} 5th {77} 5th {17}	5th {67} 5th {33}	3 {72} 2 {14}	3 {53} 2 {44}	4 {71}	4 {82}	5 {29}	5 {9}	
<i>H. corn. planaltica</i>	5,7	5	5th {54} 5th {32}	5th {58} 5th {32}	3 {53} 2 {25}	3 {83} 3 {17}	4 {82}	4 {91}	5 {18}	3 {9}	
<i>H. psilus</i>	5		6th {80}	5th {50}	3 {80}	2 {80}	5 {90}	4 {80}	5 {90}	4 {80}	
<i>H. manni</i>	2		5th {50}	5th {100}	2 {20}	3 {20}	4 {10}	5 {20}	5 {100}	4 {100}	
<i>H. marchali</i>	8,11	2,5	5th {90}	5th {85}	2 {85}	2 {94}	4 {94}	4 {100}	3 {8}	3 {3}	
<i>H. peralta</i>	12,10-11		5th {91}	5th {57}	3 {8}	1 {6}	4 {94}	4 {100}	1 {3}	1 {3}	
			4th {2}	7th {4}	1 {3}	1 {3}	4 {85}	4 {75}	1 {3}	3 {23}	
					1 {3}	1 {3}	5 {12}	5 {2}	5 {12}	5 {2}	

*Both right and left wings of each pair have been tabulated for each specimen, e. g. for *californica* 22 front wings and 22 hind wings of males and 8 front wings and 8 hind wings of females.

Table 7

Species	Specimens tabulated		Venational Details (See headings and footnote of Table 6)									
			Distal thicker antenodal		Supratrangulars		Diapical Triangle		Total Cells			
	♂	♀	F W		H W		F W		H W		F W	
<i>H. biliosa</i>	5, 6	2, 1	8th (64) 7th (29) 9th (7)	7th (72) 8th (28)	4 (79) 3 (14) 5 (7)	3 (86) 2 (14)	5 (86) 4 (16)	4 (100)				
<i>H. joannisi</i>	2		7th (75) 8th (25)	7th (50) 6th (73)	3 (100) 3 (50)	2 (100) 2 (92)	4 (75) 5 (25)	4 (58)				
<i>H. punctata</i>	9	2	5th (100)	5th (73) 6th (18) 7th (9)	3 (50) 2 (42) 1 (8)	2 (92) 1 (8)	4 (77) 5 (23)	4 (91)				
<i>H. decessus</i>	1		5th (100)	6th (100)	4 (100)	3 (100)	6 (50) 7 (50)	6 (50) 7 (50)				
<i>H. variegata</i>	8	2	5th (70) 4th (20) 6th (10)	5th (75) 6th (15) 4th (10)	2 (60) 1 (30) 3 (10)	2 (50) 1 (50)	4 (90) 5 (10)	4 (70) 3 (20) 5 (10)				
<i>Rh. maita</i>	1		5th (100)	5th (100)	2 (100)	1 (100)	3 (100)	2 (100)				
<i>S. multicolor</i>	6	4	6th (55) 7th (30) 5th (15)	5th (80) 6th (15) 7th (5)	3 (50) 2 (45) 1 (5)	2 (95) 3 (5)	5 (70) 4 (30)	4 (90) 5 (10)				
<i>S. jalapensis</i>	5	5	7th (75) 6th (20) 8th (5)	6th (70) 5th (25) 7th (5)	3 (75) 2 (20) 4 (5)	2 (75) 3 (25)	5 (80) 6 (10) 4 (6)	4 (75) 5 (25)				
<i>S. dugesi</i>	1	1	7th (75) 6th (25)	7th (75) 6th (25)	3 (100)	3 (50) 2 (50)	5 (50) 4 (50)	5 (50) 4 (50)				
<i>M. brevisfrons</i>	9, 13	4, 7, 6	5th (96) 4th (4)	5th (96) 6th (4)	2 (45) 1 (45) 3 (5) 0 (5)	1 (88) 2 (12)	3 (71) 2 (16) 4 (13)	2 (63) 3 (34) 1 (3)				
<i>M. intricata</i>	9	10	5th (87) 4th (8) 5th (5)	5th (95) 6th (5)	1 (56) 2 (44)	1 (83) 2 (14) 3 (3)	4 (61) 3 (33) 5 (6)	3 (57) 3 (30) 1 (3)				
<i>M. vigintipunctata</i>	8	1	5th (83) 4th (11) 6th (5)	5th (78) 6th (22)	2 (83) 1 (11) 3 (6)	2 (51) 1 (33) 3 (6)	4 (89) 5 (11)	4 (83) 3 (17)				
<i>M. pallipes</i> (from Fraser)	1				2	1	4	3				

Table 8

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)									
		Distal thicker antenodal Supratrangulars					Discal Triangle				
		Total Cells					Total Cells				
		P W	H W	F W	H W	F W	H W	F W	H W	F W	H W
N. diffinis diff. Pacifico slope	♂										
	♀										
N. diffinis diff. Atlantic slope	5-11	5th (95) 6th (5)	5th (85) 6th (10) 4th (5)	0 (100)	0 (94) 1 (6)	3 (91) 2 (9)	3 (68) 4 (27) 2 (5)				
	3, 5	5th (94) 4th (6)	5th (88) 4th (6) 6th (6)	0 (75) 1 (25)	0 (80) 1 (20)	3 (95) 4 (5)	3 (70) 4 (30)				
N. diff. absoluta	5	5th (90) 6th (10)	5th (85) 6th (15)	0 (100)	0 (95) 1 (5)	3 (100)	3 (75) 4 (25)				
	5, 6	5th (100)	5th (91) 6th (9)	0 (100)	0 (95) 1 (4)	3 (96) 4 (4)	3 (96) 2 (4)				
N. galapagoensis	4	5th (67) 6th (17) 7th (11)	5th (67) 6th (17) 7th (17)	0 (72) 1 (17) 2 (6)	0 (61) 1 (39)	3 (78) 4 (11) 2 (6)	3 (83) 4 (11) 2 (6)				
	5	lost (5) 5th (85) 4th (10) 6th (5)	5th (85) 6th (10) 4th (5)	0 (100)	0 (100)	lost (6) 3 (100)	lost (6) 3 (70) 4 (30)				
Co. luteipennis lut. Brazil	6	8th (55) 7th (38) 9th (6)	7th (75) 8th (12) 6th (12)	3 (72) 4 (28)	3 (67) 2 (33)	4 (88) 3 (12)	4 (75) 3 (19) 5 (6)				
	5	8th (45) 7th (32) 9th (23) 7th (50) 8th (42) 9th (8)	7th (64) 6th (23) 8th (14) 7th (50) 6th (33) 8th (17)	3 (55) 4 (45)	3 (73) 4 (14) 2 (14) 3 (68) 2 (33) 4 (8)	4 (91) 5 (9) 3 (4) 4 (58) 3 (33) 5 (8)	4 (82) 5 (14) 3 (4) 4 (58) 3 (33) 5 (8)				
Co. lut. peninsularis Baja California	2	7th (75) 8th (25) 7th (50) 8th (50)	7th (75) 6th (25) 7th (80) 6th (20)	3 (100)	3 (75) 2 (25) 3 (50) 4 (20)	4 (75) 3 (25) 4 (90) 5 (10)	3 (75) 4 (25) 4 (90) 5 (80)				
	1	8th (100)	7th (100)	4 (100)	3 (100)	4 (100)	4 (100)				
Co. rufipennis	4	9th (54) 8th (19) 10th (13) 7th (8)	7th (44) 8th (44) 9th (8) 11th (2) lost (2)	4 (68) 5 (17) 3 (7) 5 (5) lost (2)	3 (60) 4 (30) 2 (8) lost (2)	5 (40) 5 (40) 4 (12) lost (2)	4 (60) 5 (35) 5 (2) lost (2)				
	15	lost (4) lost (2)	lost (2) lost (2)	lost (2) lost (2)	lost (2) lost (2)	lost (2) lost (2)	lost (2) lost (2)				

Table 9

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)					
		Distal thicker antenodal Supratrangulars			Discoidal Triangle		
		Total Cells			Total Cells		
		F W	H W	F W	H W	F W	H W
Co. adnexa	♂	7th {70}	7th {52}	3 {80}	3 {90}	4 {77}	4 {84}
	♀	8th {23}	8th {48}	4 {16}	4 {9}	5 {18}	5 {8}
	12	6th (4)		2 (4)	4 (2)	5 (4)	3 (7)
	10	9th (2)					
Co. verrensi		9th (60)	8th (50)	4 {70}	3 {60}	4 {50}	4 {70}
		10th (20)	7th (40)	5 {30}	4 {40}	5 {30}	5 {20}
		8th (10)				6 {10}	3 {10}
		7th (10)					
Ca. januaria		7th (86)	7th (54)	2 {57}	2 (100)	3 {64}	3 {79}
	5	8th (7)	8th (21)	3 {36}		5 {25}	4 {21}
		6th (7)	8th (14)	4 (7)		4 (7)	
				3 (100)	3 (100)		
Ca. longfieldae	1 (from Kimmins)	7th (73)	7th (50)	3 {55}		4 {50}	3 {50}
	5	6th (18)	6th (41)	2 {70}	3 {35}	3 {35}	4 {20}
		8th (5)	8th (9)	4 {15}	4 (5)	5 (5)	5 (20)
		9th (5)					
Ca. oolorata	1	6th (50)	6th (50)	2 {75}	2 (100)	3 {75}	3 (100)
		7th (25)	5th (50)	lost (25)		lost (25)	
		lost (25)					
		7th (40)	7th (60)	3 {50}	3 {90}	4 {60}	4 {90}
Ca. ooronata	5	9th (40)	6th (20)	4 {50}	2 {10}	5 {30}	5 {10}
		8th (20)	9th (10)			6 {10}	
			8th (10)				

Discoidal Triangle Internal Triangle Cubital Crossveins*

	Specimens	Cells at Prox. Side		Total Cells		F W		H W	
		F W	H W	F W	H W	F W	H W	F W	H W
Ae. unicolor	1	2 (100)	2 (100)	2 (100)	2 (100)	5 (100)	4 (100)		
	1	2 (100)	2 (100)	2 (100)	2 (100)	5 (50)	4 (100)		
H. oalifornica	11, 10	2 {90}	2 {97}	1 {73}	2 {90}				
	4	1 {10}	1 {3}	2 {27}	1 {10}				
H. haarupi	2	2 (100)	2 (100)	2 {75}	2 (100)	4 {75}	3 {88}		
				1 {25}		3 {25}	2 {12}		
H. williamsianana	1	2 (100)	2 (100)	2 (100)	2 (100)	4-6	3 {50}		
	1	2 (100)	2 (100)	2 (100)	2 (100)	4-6	4 (50)		

*Excluding the internal triangle but including the anal crossvein.

Table 10

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)					
		Discoidal Triangle		Internal Triangle		Cubital Crossveins	
		Cells at Prox. Side		Total Cells		(See footnote Table 9)	
		F W	H W	F W	H W	F W	H W
<i>H. confusa</i>	♂ 5 ♀ 5	2 (100)	2 (100)	2 (95) 1 (5)	2 (100)	3 (65) 4 (30) 2 (5)	3 (70) 2 (30)
<i>H. oorn. oornigera</i>	12, 10, 5, 2	2 (100)	2 (94) 1 (6)	2 (97) 1 (3)	2 (100)	4 (80) 5 (13) 3 (7)	3 (97) 4 (3)
<i>H. corn. planaltica</i>	6 5, 3	2 (100)	2 (100)	2 (100)	2 (100)	4 (86) 3 (9) 5 (5)	3 (95) 4 (5)
<i>H. psilus</i>	5	2 (100)	2 (100)	2 (100)	2 (100)	4 (70) 5 (30)	3 (100)
<i>H. manni</i>	2	2 (100)	2 (100)	2 (100)	2 (100)	4 (75) 5 (25)	3 (100)
<i>H. marchali</i>	14, 11 6, 4	2 (98) lost (2)	2 (100)	2 (98) lost (2)	2 (98) 1 (2)	4 (56) 3 (40) lost (3)	3 (76) 2 (20) 1 (3)
<i>H. peralta</i>	16, 10 14, 3	2 (90) 1 (10)	2 (90) 1 (10)	2 (96) 1 (2)	2 (100)		
<i>H. biliosa</i>	6, 5 1, 2	2 (100)	2 (100)	2 (100)	2 (100)	5 (86) 6 (7) 7 (7)	3 (78) 4 (21)
<i>H. joannisi</i>	2	2 (100)	2 (100)	2 (100)	2 (100)	4 (75) 5 (25)	3 (100)
<i>H. punctata</i>	9 2	2 (100)	2 (100)	2 (100)	2 (91) 1 (9)		
<i>H. decussus</i>	1	2 (100)	2 (100)	2 (100)	2 (100)	4 (50) 5 (50)	4 (100)
<i>H. variegata</i>	8 2	2 (100)	2 (100)	2 (90) 1 (10)	2 (100)	3 (55) 4 (45)	3 (95) 2 (5)
<i>Rh. malta</i>	1	1 (100)	1 (100)	1 (100)	1 (100)	4 (100)	3 (100)
<i>S. multicolor</i>	6 4	2 (100)	2 (100)	2 (100) 1 (5)	2 (95) 1 (5)	3 (55) 4 (45)	3 (75) 2 (20) 4 (5)
<i>S. jalapensis</i>	5 5	2 (100)	2 (100)	2 (100)	2 (100)	4 (75) 3 (25)	3 (75) 2 (15)
<i>S. dugesi</i>	1 1	2 (100)	2 (100)	2 (100)	2 (100)	4 (50) 5 (50)	3 (100)

Table 12

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)					
		Discoidal Triangle		Internal Triangle		Cubital Crossveins	
		Cells at Prox. Side		Total Cells		(See footnote Table 9)	
		F _W	H _W	F _W	H _W	F _W	H _W
<i>Co. rufipennis</i>	♂ 4 ♀ 1	1 (100) 2 (10)	1 (90) 2 (10)	1 (100) 2 (10)	1 (90) 2 (10)	4 (90) 3 (10)	3 (90) 2 (10)
<i>Co. secreta</i>	1	1 (100)	1 (100)	1 (100)	1 (100)	4 (100)	3 (100)
<i>Co. viriditas</i>	9.5 15.10	2 (54) 1 (44) lost(2)	1 (96) 2 (2) lost(2)	2 (50) 1 (48) lost(2)	2 (98) 1 (48) lost(2)	4 (57) 5 (37) 3 (3)	3 (87) 4 (10) lost(3)
<i>Co. adnexa</i>	12 10	1 (100)	1 (98) 2 (2)	1 (95) 2 (4)	1 (100)	4 (84) 5 (11) 3 (4)	3 (95) 2 (4)
<i>Co. perrensi</i>	5	1 (70) 2 (30)	1 (100)	1 (70) 2 (30)	1 (100)	4 (50) 5 (50) 4 (10)	3 (90) 4 (10)
<i>Ca. januaria</i>	5 2	1 (71) 2 (29)	1 (79) 2 (21)	1 (100)	1 (100)	4 (86) 3 (14) 2 (14)	3 (86) 2 (14) 3 (90)
<i>Ca. oastor</i>	5 5	1 (75) 2 (25)	1 (65) 2 (35)	1 (90) 2 (10)	1 (100)	4 (90) 5 (10) 3 (50) 4 (25) lost(25)	3 (90) 2 (10) 3 (100)
<i>Ca. oolorata</i>	1 1	1 (75) lost(25)	1 (100) lost(25)	1 (75) lost(25)	1 (100)	3 (50) 4 (25) lost(25)	3 (100)
<i>Ca. coronata</i>	5	1 (60) 2 (40)	1 (90) 2 (10)	1 (90) 2 (10)	1 (100)	4 (50) 5 (50) 4 (20) 5 (20)	3 (60) 4 (20) 5 (20)
<hr/>							
Level where 2 rows of cells betw. M1 and M2 begin (M1a?)							
Prox. to Stigma		Under Stigma		Distal End of Sigma		Distal to Stig.	
F _W	H _W	F _W	H _W	F _W	H _W	F _W	H _W
1		(100) (100)	(100) (100)	(100) (100)			
<i>Ae. unicolor</i>	1						
<i>Ae. rufipes</i>	6						
<i>H. californica</i>	2						
<i>H. haarupi</i>	1						
<i>H. williamsiana</i>	6						
<i>H. confusa</i>	1						
<i>H. corn. cornigera</i>	8						
<i>H. corn. planaltica</i>	6						
<i>H. psilus</i>	5						
<i>H. manni</i>	2						
<i>H. marchali</i>	7						
<i>H. peralta</i>	5						
		(28) (11) (56) (17) (14) (100) (19)	(56) (72) (89) (83) (79) (100) (25)	(75) (100) (100) (44) (83) (79) (25)	(25) (21) (46) (7) (19) (25)	(100) (79) (75) lost(6) (25)	(100) (50) (56) (75) (55)

Level where 2 rows of cells betw. M1 and M2 begin (M1a?)
Prox. to Stigma Under Stigma Distal End of Stigma Distal to Stig.

Table 13

Species

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)									
		Level where 2 rows of cells betw. M1 and M2 begin									
		Prox. to Stigma Under Stigma Distal End of Stigma Distal to St1									
		♂	♀	F W	H W	F W	H W	F W	H W	F W	H W
<i>H. biliosa</i>	5	1	(67)								
<i>H. joannisi</i>	2	1	(33)	(83)	(67)						
<i>H. punctata</i>	5	2	(50)	(100)	(25)*						
<i>H. decessus</i>	1			(100)	(100)	(93)#					
<i>H. variegata</i>	8	2		(100)	(100)	(10)	(25)**	(20)	(70)	(70)	
<i>Rb. maiba</i>	1	(paratype)		(50)z	(100)						
<i>S. multicolor</i>	5	5			(5)		(45)	(40)		(100)	(100)
<i>S. jalapensis</i>	5	5								(50)	(45)#
<i>S. dugesi</i>	1	1								(100)	(100)
<i>M. brevifrons</i>	9	9	(71)	(79)	(29)	(21)					
<i>M. intricata</i>	9	9	(44)	(81)	(55)	(19)					
<i>M. vinctipunctata</i>	8	1	(66)	(89)	(28)q	(6)q					
<i>N. diffinis</i> diff.	5	5				(15)	(50)	(50)		(35)	
<i>N. diff. absoluta</i>	5	5			**	(15)	(15)	(20)		(80)	(55)
<i>N. elsia</i>	5	5				(40)	(70)	(50)		(30)	
<i>N. galapagoensis</i>	4	4			(25)y	(31)	(55)	(63)		(13)	y
<i>N. bonariensis</i>	5	5			(5)	(10)	(60)	(75)		(35)	(15)
<i>Co. luteipennis</i> lut.	4	1			(70)	(100)	(30)				
<i>Co. lut. florida</i>	6	5			(100)	(100)	(20)				
<i>Co. lut. mainland</i>	5	5			(80)	(100)					
<i>Co. lut. peninsularis</i>	2	2			(100)	(100)					
<i>Co. rufipennis</i>	5	5			(100)	(100)					
<i>Co. seoreta</i>	1	1			(100)	(100)					
<i>Co. ingens</i>	5	5						(5)		(100)	(100)
<i>Co. viriditas</i>	5	5						(10)		(100)	(95)
<i>Co. adhexa</i>	5	5						(10)		(100)	(90)
<i>Co. perrensi</i>	5	5								(80)	
<i>Ca. januaris</i>	5	2			(10)	(10)	(10)				
<i>Ca. longfieldae</i>	1	(from Kimmins)			(100)	(100)					
<i>Ca. castor</i>	5	5			(100)	(95)#					
<i>Ca. colorata</i>	1	1			(75)*	(75)yy					
<i>Ca. coronata</i>	5	5			(100)	(100)					

* Damaged FW (25) # Level of proximal end of stigma HW (7) ** Lost FW (5) ## Damaged HW (5)
 z Level of proximal end of stigma FW (50) y Damaged FW (6) HW (6) yy Damaged HW (25)
 q No data FW, HW (6).

Table 14

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)											
		Anal. I+II H W	Anal. I+II H W	Anal. Loop H W	Supp. Loop H W	Anal. Rows of Cells H W	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma
Ae. unicolor	♂ 1,2	3(50)	4(50)	3(50)	2(50)	2(100)	F W H W F W H W F W H W F W H W	3(100)	4(100)	3(100)	4(100)	1(100)	1(100)
Ae. rufipes	1			3(100)			3(100)	4(50)	4(100)	3(100)	4(100)	1(100)	2(100)
H. californica	5	3(100)		2(100)			2(61) 3(39)	2(57) 3(33)	3(100)	3(100)	4(100)	1(100)	2(100)
H. haarupi	2	3(100)		3(100)			3(50) 2(50)	3(100)	3(100)	3(100)	4(100)	1(100)	2(100)
H. williamsiana	1	3(100)		3(100)			3(100)	3(100)	3(100)	3(100)	4(100)	1(100)	2(100)
H. oonfusa	5	3(92) 4(8)		3(90) 2(10)			3(85) 2(13)	3(90) 2(15)	3(100)	3(100)	4(100)	1(100)	2(100)
H. corn. oornigera	#	3(98.33) 4(1.57)		3(100)			3(53) 2(41.2)	3(94) 4(5)	3(100)	3(100)	4(100)	1(97)	2(3)
H. corn. planaltica	#	3(99) 2(1)		3(100)			3(40) 2(40)	3(94) 4(5)	3(100)	3(100)	4(100)	1(100)	2(100)

**No data (25) y Irregular (20) z Ill-defined (5)
 # The specimens of corn. oornigera tabulated are anal trl. 50δ, 23♀; anal loop 15δ, 7♀; supp. anal loop 15δ, 2♀; rows in fork of Rs 60δ, 23♀; rows betw. fork of Rs & Rspl 10δ, 5♀; rows betw. M4 & M4spl 10δ, 5♀. ## Corresponding numbers for corn. planaltica are 62δ, 11♀; 83δ, 5♀; 73δ, 2♀; 52δ, 11♀; 6δ, 5♀ and 6δ, 5♀.

Table 15

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)									
		Total Cells H W	Anal Tri. H W	Loop Hor- iz. Rows of Cells H W	Supp. Anal Loop H W	Max.No. Rows of Cells in Cells bet. fork of Rs under Stigma F W	Max.No. Rows of Cells bet. M4-M4spl Cu1 & Cu2 H W	Max.No. Rows of Cells bet. M4-M4spl Cu1 & Cu2 F W	Max.No. Rows of Cells bet. M4-M4spl Cu1 & Cu2 H W	Max.No. Rows of Cells bet. M4-M4spl Cu1 & Cu2 F W	Max.No. Rows of Cells bet. M4-M4spl Cu1 & Cu2 H W
H. psilus	♂ 16-5	3(100) 3(20)	3(100)	2(80) 3(20)	3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)
H. manni	♀ 2	3	3(100)	2(50) 3(50)	3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)
H. marohali	13, 11 5, 4 7	3(100)	3(100)	3(76) 2(20)**	3(100)	3(94) # 3(100) 2(7) #	3(86) 3(97) #	3(97) # 3(97) #	3(97) # 3(97) #	3(97) # 3(97) #	3(97) # 3(97) #
H. peralta	13, 10 13, 11	3(95) 4(5)	3(73) 2(27)	3(73) 2(27)	3(73) 2(27)	3(86) 4(14)	3(86) 4(14)	3(86) 4(14)	3(86) 4(14)	3(86) 4(14)	3(86) 4(14)
H. billosa	6, 5 1, 2	3(85) 4(15)	3(85) 2(14)	3(79) 4(14) 2(7)	3(77) 4(23) 3(59) 4(41)	3(86) 4(14) 3(59) 4(41)	3(86) 4(14) 3(59) 4(41)	3(86) 4(14) 3(59) 4(41)	3(86) 4(14) 3(59) 4(41)	3(86) 4(14) 3(59) 4(41)	3(86) 4(14) 3(59) 4(41)
H. joannisi	2	3(100)	3(100)	3(75) 3, 2 (25)	3(75) 2(25)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)	3(100) 3(100)
H. punctata	9 2 3	3(95)	3(95)	3(95)	3(95)	3(95)	3(95)	3(95)	3(95)	3(95)	3(95)
H. dcessus	1	3(100)	3(50)	irreg	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)
H. variegata	8 2	3(100)	3(100)	3(60) 2(15) 4(10) yy	3(60) 2(15) 4(10) yy	3(60) 2(15) 4(10) yy	3(60) 2(15) 4(10) yy	3(60) 2(15) 4(10) yy	3(60) 2(15) 4(10) yy	3(60) 2(15) 4(10) yy	3(60) 2(15) 4(10) yy

*Damaged HW(25). **Damaged HW(3). #Damaged FW(6). ##Damaged FW(7). zDamaged FW(3).
y Irregular HW(5). zz No data FW, HW (9). yy Irregular HW(15). q Damaged FW(5). t Damaged HW (5).

Table 16

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)									
		Anal Tri.	Anal Loop	Supp. Anal	Max.No. Rows of Cells in Cells bet. fork of Rs under Rs & Rspl	Max.No. Rows of Cells in Cells bet. fork of Rs under Rs & Rspl	Max.No. Rows of Cells in Cells bet. fork of Rs under Rs & Rspl	Max.No. Rows of Cells in Cells bet. fork of Rs under Rs & Rspl	Max.No. Rows of Cells in Cells bet. fork of Rs under Rs & Rspl	Max.No. Rows of Cells in Cells bet. fork of Rs under Rs & Rspl	Max.No. Rows of Cells in Cells bet. fork of Rs under Rs & Rspl
		♂	♀		♂	♀	♂	♀	♂	♀	♂
Rh. maia	1(photo.)	3(100)	3(100)	2(100)	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)
S. multicolor	5, 6	4	3(100)	2(65) 3(35)	2(50) 3(45) 2-3(5)	3(75) 4(15) 2(5)*	3(75) 4(25) 3(55) 4(40) 4(15) 2(5)**	3(75) 4(30) 4(60) 3(40)	3(70) 4(30) 4(60) 3(40)	1(100) 2(100)	1(100) 2(100)
S. jalapensis	5	5	3(100)	3(95)**	3(50) 2(35) 4(5)** 3-2(5)	3(50) 4(60) 4(55) 3(40)**	4(55) 3(45) 4(75) 3(15) 5(15)**	3(85) 4(15) 4(65) 3(20) 5(10)**	1(100) 2(95)	1(100) 2(95)	1(100) 2(95)
S. dugesi	1	1	3(100)	3(100)	3(100)	3(50) 4(50)	4(50) 3(50)	4(100) 5(50)	1(100) 2(100)	1(100) 2(100)	1(100) 2(100)
M. brevifrons	9, 13	4-7	3(100)	2(70) 3(20)**	2(94) 3(3) 2-3(3)	3(73) 2(27) 3(77) 2(23)	3(85) 2(15) 3(85) 2(15)	3(50) 2(50) 2(78) 3(19)z	1(100) 2(53) 1(17)	1(100) 2(53) 1(17)	1(100) 2(53) 1(17)
M. intricata	9	9, 10	3(74) 2(21) 4(3) 5(3)	3(59) 2(28) 1(13) 1(13)	2(71) 2(28) 2-3(8)y	3(58) 2(42) 3(53) 2(39)** 3-4(3)	3(58) 2(39)zz 3(82) 2(18) 3-4(3)	3(50) 2(50) 3(55) 2(42) 4(3)	1(100) 2(92) 1(3) 2(42) 4(3)	1(100) 2(92) 1(3) 2(42) 4(3)	1(100) 2(92) 1(3) 2(42) 4(3)

*Damaged FW (5). **Damaged HW (5). #No data HW (50). ##Irregular HW (10). z Damaged HW (3)
y Irregular HW (8). zz Damaged FW (3). yy Irregular HW (5).

Table 17

Species	Specimens tabulated	♂	♀	Venational Details (See headings and footnote of Table 5)										
				Anal Tri.	Anal Loop	Supp. Anal	Max. No. Rows of Cells	Max. No. Rows of Cells	Max. No. Rows of Cells	Max. No. Rows of Cells	Max. No. Rows of Cells	Max. No. Rows of Cells	Max. No. Rows of Cells	
				Total Vert. Rows of Cells	Loop	Hor- rows	Cells in Cells bet. fork of Rs under Rs & Repl	Stigma	F W	H W	F W	H W	F W	H W
<i>M. vigintipunctata</i>	8	1	♂	3(100)	3(78)	2(50)	3(83)	3(61)3(55)3(89)	4(17)	4(33)4(39)2(5)	3(89)	4(5)	1(100)2(100)	
					Irreg(11)	2-3(28)								
					4(6)	3(22)	3(61)							
					2-3(6)		4(39)							
<i>M. pallipes</i> (from Fraser)	1						3	3	3	3	3	3		2
<i>N. diffinis</i> diff.														
<i>N. Pacific</i> slope	11.6	8.6			2(100)		3(68)							
							2(37)							
							3(84)							
							2(42)							
							4(4)							
							3(100)							
<i>N. diff. absoluta</i>	4.5	5	5.4	3(100)	2(95)	2(80)	3(95)	3(95)	4(5)	3-4(6)	3(100)	1(100)	2(100)	
					3(5)	3(15)								
						3-2(5)								
							3(90)							
							4(10)							
<i>N. elsia</i>	5.6	6.5	3(100)	2(100)	2(100)	2(100)	3(100)	3(100)	3(92)	3(100)	3(100)	1(100)	2(100)	
							4(8)							
<i>N. galapagoensis</i>	3.4	5	3(100)	2(94)	2(94)	2(94)	3(89)	3(89)	q	4(6)	3(94)	1(100)	2(100)	
				3(6)	zz	zz								
							3(67)	4(6)						
							4(22)	zz						
							3(39)	zz						
							q							
<i>N. bonariensis</i>	5	5		2(90)	2(91)	2(91)	3(100)	3(90)	3(100)	3(100)	3(90)	1(100)	2(100)	
				2-3(10)	3(9)									

* No data (G).

y Abnormal (4). zz Damaged (6). q Damaged (11).

Table 18

Species	Specimens tabulated	Sex	Venational Details (See headings and footnote of Table 6)									
			Anal Tri.	Anal Loop	Supp. Anal	Max. No. Rows of Cells	Max. No. Rows of Cells in fork of Rs under Rs & Rsp1	Max. No. Rows of Cells bet. fork of M4-M4sp1	Max. No. Rows of Cells be. Cul-Cu2	Max. No. Rows of Cells	Max. No. Rows of Cells	Max. No. Rows of Cells
			H W	H W	H W	H W	H W	H W	H W	H W	H W	H W
Co. luteipennis lut. Brazil	4-7	♂	2(100)	3(89) 2(11)	2(39) 3-2(12) 3(6)*	2(100) 2(88) 3(12)	5(94) 4(6)	3(100)	1(100)	3(56) 4(44)	1(56) 2(44)	
Co. lut. florida Costa Rica	6	5		3(91) 3-4(9)	2(73) 3(18) 3-2(9)	2(100) 2(95) 3(5)	5(69) 6(23) 5(73) 6(14) 4(9) 5,4(5)	3(25) 3(25) 4(68) 3(32)	1(100)	2(55) 1(45)		
Mexico, mainland	6			3(100)	2(100)	2(100) 2(100)	5(75) 4(25)	3(100) 3(75) 4(25)	1(100)	1(67) 2(33)		
Co. lut. peninsularis	2			3(100)	2(100)	2(100)	5(100)	3(100)	1(100)	1(100)		
Co. rufipennis	4, 3	1		3(100)	2(80) 3(10)*	2(100) 2(100)	5(70) 6(30)	3(100) 4(60) 5(90) 6(10)	1(100)	1(70) 2(30)		
Co. seoreta	1			3(100)	#	2(100)	4(100)	3(100)	1(100)	1(100)		
Co. viriditas	9-4	8-13	2(100)	3(88) 2(8) # z	2(46) 1-2(8) # z z	2(90) 3(5) z y	8(50) 5(20) 7(20)	3(80) 4(17) z	1(97)	2(73) 1(23) z		
						2(95) z z y y	5-6(7) z	4(83) 3(13) z				

* Not well-defined, lut. lut. (44), viriditas (42).

** Irregular (8). # Ill-defined rufipennis (10), seoreta (100).

No data (2, 5). z Lost (2, 5). z z Lost (4).

y Damaged (2). yy Damaged (2).

Table 19

Species	Specimens tabulated	Venational Details (See headings and footnote of Table 6)									
		Total Cells	Anal Tri.	Supp. Anal	Max. No. Rows of Cells	Max. No. Rows of Cells bet. fork of Rs	Max. No. Rows of Cells bet. fork of M4-M4spl	Max. No. Rows of Cells bet. fork of Cu1-Cu2	Max. No. Rows of Cells bet. fork of Cu1-Cu2	Max. No. Rows of Cells bet. fork of Cu1-Cu2	Max. No. Rows of Cells bet. fork of Cu1-Cu2
		H W	H W	H W	H W	H W	H W	H W	H W	H W	H W
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Co. adnexa	3-12	3(100)	3(98)	2(100)	2(100)	2(100)	2(100)	2(100)	2(100)	2(100)	2(100)
Co. perrensi	5	1	2(100)	3(100)	2(20)	2(20)	2(100)	2(100)	2(100)	2(100)	2(100)
Ca. januaria	5-8	2	2(100)	3(79)	2(14)	2(14)	2(14)	2(14)	2(14)	2(14)	2(14)
Ca. longfieldae	1 (from Kimmins)										
Ca. castor	5	5	2(90)	3(10)	3(95)	3(10)	3(10)	3(10)	3(10)	3(10)	3(10)
Ca. colorata	1	1	2(100)	3(100)	2(100)	2(100)	2(100)	2(100)	2(100)	2(100)	2(100)
Ca. coronata	5		2(100)	3(100)	2(80)	2(80)	2(100)	2(100)	2(100)	2(100)	2(100)

* Not well-defined. # Damaged. ** Irregular. ## Lost.



Map 1

(The following maps are based on Goode Base Maps No. 103 and 201 HCW.
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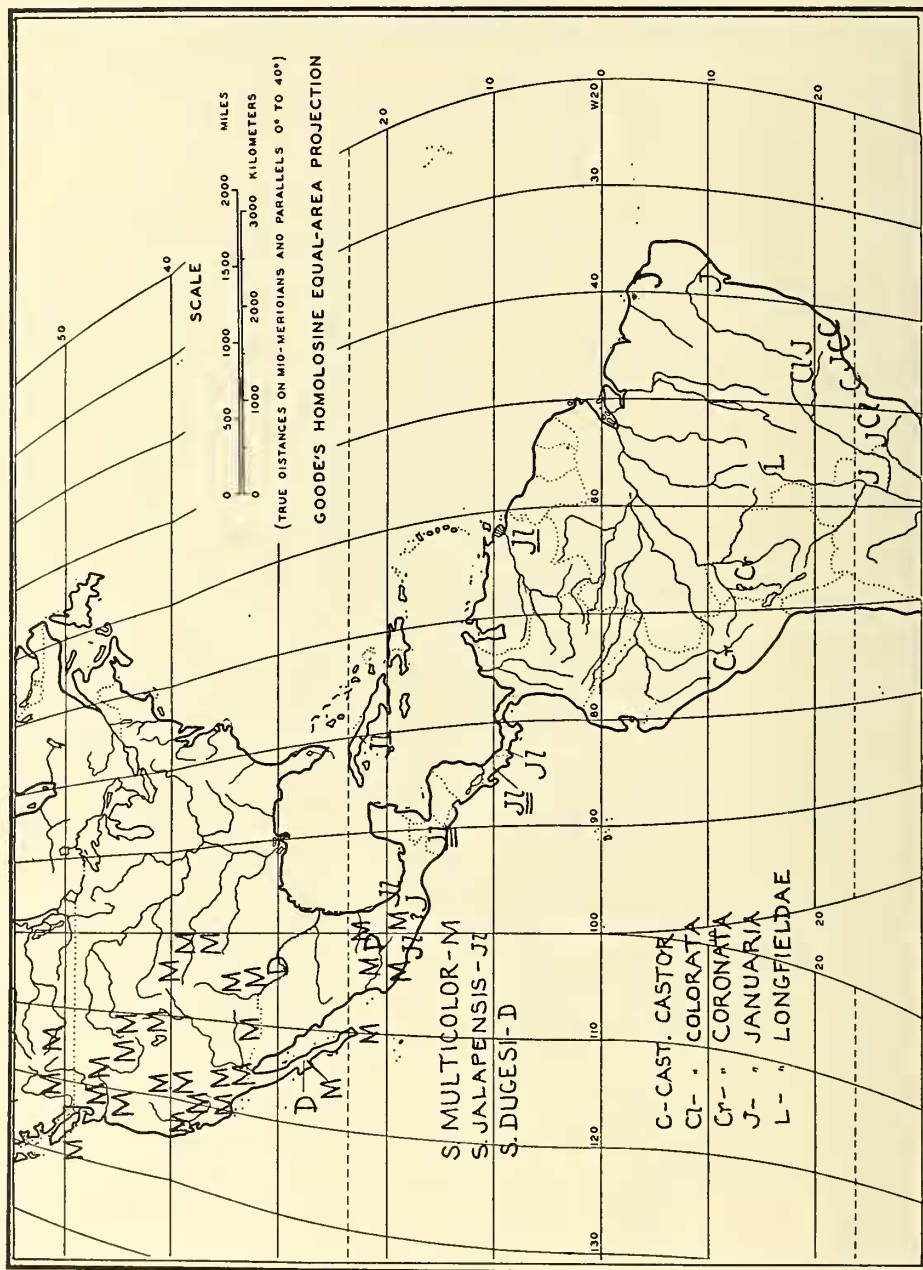
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C VICTORIA
 C OGDEN
 RENO
 C TOMBSTONE
 W CUERN
 Cg VS MARIA
 C TIERRA BLANCA
 C MERIDA
 TCg
 Cg ARITACUA
 Cg R/O BALSAS
 Cg R/O VELHO
 Cg C DERENE
 C SONGO
 C SANTIAGO, R.JAN.
 S PAULO
 CH TAPIA, BAPUCAY
 N TEUTONIA
 C R G S SUL
 CURICO, BAIRE
 MONTEVIDEO
 ANGOL
 NAHUEL HUAPI
 ISLAND HARBOR
 PTA ARENAS
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 9842
 6562
 3281
 1640
 656
 0

Map 2



Map 3

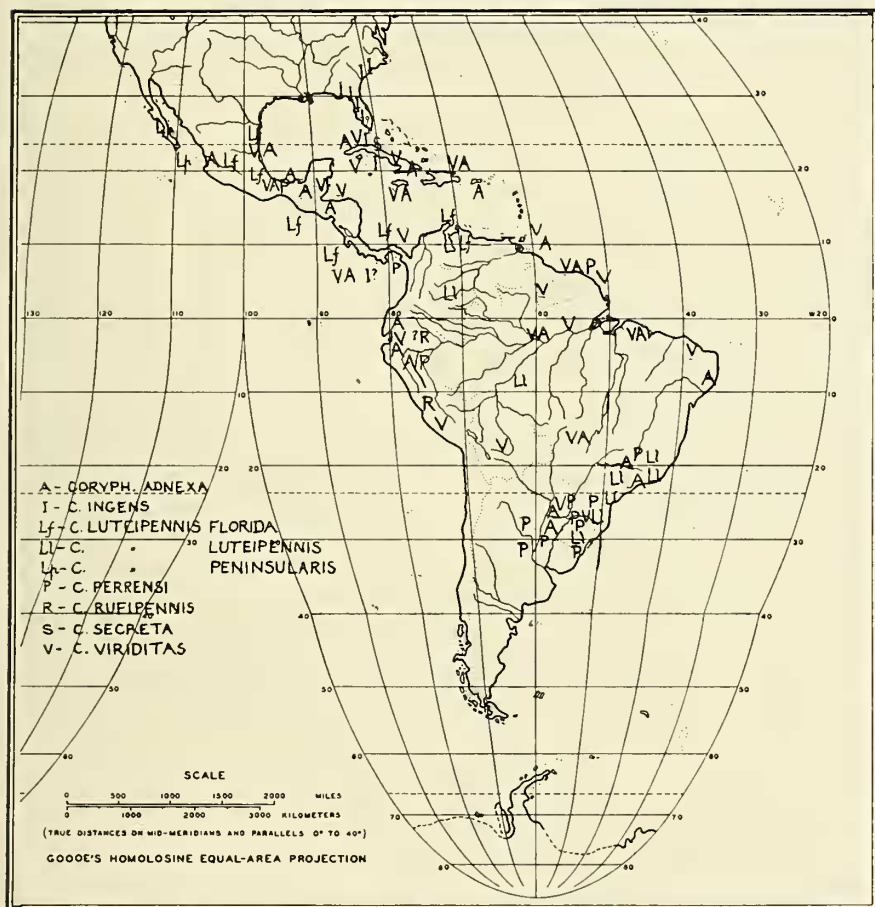




Map 5



Map 6



Map 7

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